"POLITEHNICA" UNIVERSITY OF TIMIŞOARA
FACULTATY OF ELECTRONICS AND TELECOMMUNICATIONS

CURRICULA AND SYLLABI

Major: ELECTRONICS AND TELECOMMUNICATIONS

- BACHELOR STUDIES -

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ACADEMIC YEAR 2014 - 2015

CURRICULUM

Major: Electronics and Telecommunications – Bachelor Studies in English

Item no	Discipline	C	S	L	P	Cr/Ex*
Ist Year 1st Semester						
1	Mathematics I	2	2	0	0	4/E
2	Mathematics II	2	2	0	0	4/E
3	Mechanics	2	2	0	0	4/E
4	Electrical Circuits	2	0	2	0	5/E
5	Introduction to Computer Programming	2	0	2	0	4/D
6	Experimental Data Processing	1	0	1	0	3/D
7	Culture and Civilization	1	1	0	0	2/D
8	Second Language	0	2	0	0	2/D
9	Sport	0	1	0	0	2/D
	Total	**12**	**10**	**5**	**0**	**30**
Ist Year 2nd Semester						
1	Mathematics III	2	2	0	0	4/E
2	Mathematics IV	2	1	1	0	4/D
3	Materials Science	2	0	2	0	4/E
4	Physics	3	1	1	0	5/E
5	Electronic Devices	2	0	2	0	4/E
6	Applied Computer Programming	2	0	2	0	4/D
7	Second Language	0	2	0	0	3/D
8	Sport	0	1	0	0	2/D
	Total	**13**	**7**	**8**	**0**	**30**
IInd Year 3rd Semester						
1	Electronic Circuits	2	0	2	0	5/E
2	Engineering Electromagnetics	2	1	1	0	4/D
3	Signals and Systems	2	1	1	0	4/E
4	Digital Integrated Circuits	2	0	2	0	4/E
5	Computer Aided Design	2	0	2	0	4/D
6	Electrical and Electronic Measurements	2	1	1	0	4/E
7	Second Language	0	2	0	0	3/D
8	Sport	0	1	0	0	2/D
	Total	**12**	**6**	**9**	**0**	**30**
IInd Year 4th Semester						
1	Analog Integrated Circuits	2	1	1	0	4/E
2	Microeconomics	2	1	0	0	3/D
3	Computer Networks Architecture	2	0	2	0	4/E
4	Object Oriented Programming	2	0	2	0	4/D
5	Signal Processing	2	0	2	0	5/E
6	Microprocessors and Microcontrollers	2	0	2	0	5/E
7	Electronic Circuits Project	0	0	0	2	2/D
8	Sport	0	1	0	0	1/D
10	Practical Training (40 hours)	0	0	0	0	2/C
	Total	**12**	**3**	**9**	**2**	**30**

Legend

C	S	L	P	Cr/Ex*
Course	Seminar	Laboratory	Project	Credits/Examination form

* Evaluation form: E = exam; D = distributed evaluation; C = colloquium

**Choose one foreign language between English, French and German

MATHEMATICS I

A. COURSE OBJECTIVES

To build a mathematical foundation for future study. To understand the conceptual notions of differential calculus. To know common situations when differential calculus is useful and to apply it. To have a founded confidence about the problem solving abilities using differential calculus.

B. COURSE TOPICS

Numeric series.
Taylor's formula. Applications to approximation problems.
Sequences and series of functions: Power series; Fourier series.
Matrix space.
Functions of several real variables: Limits and continuity.
Partial derivatives. The differential of a map.
Extrema problems. Approximations of functions of several variables.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Working problems and reviewing material according to the course.

D. TEXTBOOKS/REFERENCES

1. D.Dăianu, *Analiză matematică;* Ed. MATRIX ROM, Bucureşti, 2005.
2. R.Borden, *A Course in Advanced Calculus*, Ed. North-Holland, 1983.
3. P.Găvruţă, D.Dăianu, C.Lăzureanu, L.Cădariu, L.Ciurdariu, *Probleme de matematică. Calcul diferenţial*, Ed. MIRTON Timişoara, 2004.

MATHEMATICS II

A. COURSE OBJECTIVES

To build a mathematical foundation for future study. To understand the conceptual notions of linear algebra. To know common situations when linear algebra is useful and to apply it. To have a founded confidence about problem solving abilities using linear algebra.

B. COURSE TOPICS

Vectors. Linear systems. The linear machinery. Linear dependence and independence. Basis. Vector coordinates. Vector spaces. Matrices. Matrix groups. Linear mappings. First and second degree varieties of the Euclidean space.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Working problems and reviewing material according to the course.

D. TEXTBOOKS/REFERENCES

1. G. Strang - Linear Algebra and its Applications, 2006
2. D. Poole - Linear Algebra, 2006

MECHANICS

A. COURSE OBJECTIVES

The purpose of course is the presentation of main elements, in order to make possible a good appropriation of this fundamental discipline and a facile approaching of allied disciplines. With the same aim, it is permanently followed the relation between the theory and the engineering practice. The method of treating is the vectorial one, because it considers that this method answers very well to the

problems concerning the study of mechanical phenomena. The presentation of material takes into account the order of apparition and the historical development of Classical Mechanics, so that the main parts of the course are: Statics, Kinematics and Dynamics

B. COURSE TOPICS

Statics: Statics of Particle: Equivalence of Concurrent Forces, Equilibrium of Particle. Statics of Rigid Body: Equivalence of Anyhow Forces, Equivalence of Coplanar Forces, Equivalence of Parallel Forces, Equilibrium o Rigid Body. Applications of Statics: Centers of Gravity. **Kinematics:** Kinematics of Particle: Elements of Motion, Study in Cartesian Coordinates, Study in Cylindrical Coordinates, Study in Intrinsic Coordinates, Particular Motions. Kinematics of Rigid Body: Particular Motions. Applications of Kinematics: Composition of Motions. **Dynamics:** Dynamics of Particle: Study with the Newton's Second Law, Study with the Theorem of Kinetic Energy, Study with the Theorem of Conservation of Mechanical Energy. Dynamics of System of Particles: Moments of Inertia, Study with the Theorems of Momentum, Study with the Theorem of Kinetic Energy, Study with the D'Alembert's Principle. Dynamics of Rigid Body: Particular Motions. Dynamics of System of Rigid Bodies: Study with the Theorems of Momentum and D'Alembert's Principle, Study with the Theorem of Kinetic Energy

C. APPLICATION TOPICS (tutorial)

The **tutorial** topics are the same as the course topics.

D. TEXTBOOKS/REFERENCES

Firk, F.,W.,K., *Essential Physics, Part1;* Yale University Publishing, Yale,2000

Norbury, J.,W., *Elementary Mechanics and Termodynamics;* Wisconsin University Publishing, Milwaukee, 2000

Rosu, H.,C., *Classical Mechanics;* Los Alamos Archives, Los Alamos, 1999

ELECTRICAL CIRCUITS

A. COURSE OBJECTIVES

The ELECTRICAL CIRCUITS course represents a first course in circuit analysis. The goal of the course is to provide an effective and efficient environment for students to obtain a thorough understanding of the essentials of electrical engineering. Emphasis is placed on the basic laws, theorems and problem solving techniques which are used in circuit analysis.

B. COURSE TOPICS

The physical foundations of electrical engineering: Fundamental electrical quantities; Electric power and energy; Passive circuit elements – resistance, capacitance, inductance; Active circuit elements – independent and dependent sources. **Circuit analysis-Resistive networks (DC steady state):** The Ohm's law; the Kirchhoff's laws; Source transformation; Linearity and superposition; Thevenin and Norton equivalent sub-circuits; Source transportation; The power conservation theorem; The maximum power transfer theorem; Nodal analysis; Loop analysis. **Sinusoidal steady-state circuit analysis:** Some general definitions. RMS value; The phasor method; Mesh and Nodal analyses; Thevenin's and Norton's method; Maximum power conditions; Power in AC circuits; Frequency response. Resonance phenomena; Two-ports networks. **Fourier series. Network response to periodic functions:** RMS value for a periodic function; Solving a circuit supplied with

periodical functions. **The transient analyses of 1st order RC and RL circuits:** the forced response; The natural response; The total response; Initial conditions; General result for 1st order RL or RC circuit.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratories: Experiments on simple DC circuits; Experiments on simple AC circuits; Low pass and high pass RC circuits; PSpice simulation of electrical circuits.

D. TEXTBOOKS/REFERENCES

1. Fitzgerald A.E., D. E. Higginbotham, A. Grabel, *Basic Electrical Engineering;* McGraw-Hill; fifth edition, 1981

2 Hayt W.H., Kemmerly J.E., Durbin S.M., *Engineering Circuit Analysis*, McGraw Hill; sixth edition, 2001

3.Nahvi M., Edminister J.A., *Electric circuits*, McGraw Hill, fourth edition, 2003

INTRODUCTION TO COMPUTER PROGRAMMING

A. COURSE OBJECTIVES

The course focuses on fundamental concepts in computer programming and provides knowledge and skills about the development of medium-level complexity programs in C programming language.

B. COURSE TOPICS

1. Fundamental concepts in Computer Programming (information, data, knowledge, informatics, communication, algorithms)
2. Logical schemes
3. Introduction to C programming language
4. Data types, Constants, variables, expressions
5. Input/output instructions
6. Decisional instructions (if, case)
7. Repetitive instructions (while, do-while, for)
8. Arrays, Pointers, Strings
9. User defined functions
10. User defined types
11. Pointers
12. Handling with files in C
13. Graphic Programming in C

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

During laboratories the students will solve specific C applications, according to the theoretical notions studied in the courses.

D. TEXTBOOKS/REFERENCES

1. Steve Holmes: *C Programming*, University of Strathclyde Computer Centre

2. Brian Kernighan and Dennis Ritchie: *The C Programming Language*, 2nd Edition, Prentice-Hall, 1988

EXPERIMENTAL DATA PROCESSING

A. COURSE OBJECTIVES

Basic knowledge on methods and tools to process, present and interpret experimental data.

B. COURSE TOPICS

Data presentation. Tables, graphs, plots, histograms. Common statistics: mean, mode, median, range, standard deviation. Typical distributions: normal, uniform. **Measurement errors and uncertainties.** Random errors, bias, outliers. Grubbs' test for outliers. Expanded uncertainty. Confidence interval and confidence level. Error propagation. **Data processing.** Averaging, Student's distribution. Data presentation rules. **Least squares method and linear regression.** Correlation. **Curve fitting.** Interpolation: linear, polynomial, trigonometric, spline.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Data presentation: tables, graphs, plots and histograms.
Measurement errors.
Error propagation.
Outliers. Identification and elimination.
Linear regression.
Interpolation.

D. TEXTBOOKS/REFERENCES

1. http:// www.itl.nist.gov/div898/handbook/index.htm

CULTURE AND CIVILIZATION

A. COURSE OBJECTIVES

Basic knowledge about culture and civilization, and especially European culture and civilization, approaching a very actual subject: European Union – the idea, the construction, the dynamics and the future.

B. COURSE TOPICS

European Construction, a marching "troop" or an endless road … (End of the Cold War. Marshall Plan. Treaty of Paris. Schuman Plan. Treaty of Rome (the steps of the creation of the European Economic Community). Treaty of Bruxelles. From six to nine, to ten, and then to twelve. Schengen Convention. White Book: Charter of the Common Market and the Fulfillment of the Treaty of Rome. European Single Act - Juridical Expression of the White Book. Treaty of Maastricht. Europe of the Fifteenth. Treaty of Amsterdam. Treaty of Nice. Lisbon Strategy. Enlargement towards the East. European Constitution Project. Turkey – a controversial country). **Institutional System and the new judicial shape (**Institutions, organs, organisms. European Commission. Council of Ministers. European Parliament. European Court of Justice. Court of Auditors. Community Organs**). European Symbols and particularities (**European flag. European anthem. Day of Europe – 9th of May. EU motto. European currency**). European Policies (**Common Policies. Accompanying Policies). **Dynamics and convergence inside European Union (**Real convergence. Nominal convergence**). Romania and the European Union (**Romanian adhesion process. Opportunity cost)

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

1. EU Construction – historical, economical, political and cultural approach
2. EU – "A Troop" in march ...
3. The enlargement of EU – Advantages and disadvantages
4. The essence and the structure of European integration process (the stages of integration)
5. EU – a "Tower of Babel" for languages and cultures …
6. EU and the challenges of world security and stability in the IIIrd

millennium

7. Romanian adhesion to EU – the price of entering ticket

D. TEXTBOOKS/REFERENCES

Vartolomei Mihaela, Staicu Florentiu, "Contemporary European Culture and Civilization", Politehnica Publishing House, Timisoara , 2008

Fontaine Pascal, "European Construction since 1945 until nowadays", European Institute, Iasi , 1998

Vartolomei Mihaela, PhD Thesis, "European Integration – the Play of Convergence", Timisoara , 2007

MATHEMATICS III

A. COURSE OBJECTIVES

Course goals : to introduce basic concepts of Integral Calculus of the functions of one and several real variables and Differential Equations; to identify specific theoretical concepts in practical situations; to formulate a practical problem in mathematical terms; to solve the problem and interpret the result.

B. COURSE TOPICS

Integrals of functions of one variable: Improper Integrals . Integrals dependent on parameters

Multiple integrals: Double integrals. Triple integrals. Change of variables in double and triple integrals

Line integrals and Surface integrals: Line integrals of the first and second type. Line integrals of the second type independent of path. Green`s formula. Surface integrals of the first and second type. Gauss-Ostrogradski`s formula.

Fields theory: Integral formulas. The divergence integral formula. The curl integral formula. The gradient integral formula. Stokes' integral formula.

Differential equations: Differential equations of the first order. Higher-order linear differential equations. Systems of differential equations.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Improper integrals. Integrals dependent on parameters. Improper integrals dependent on a parameter. Double integrals. Triple integrals. Change of variables in double and triples integrals. Line integrals of the first type and second type.

Path independence of line integrals. Green's formula. Surface integrals of the first and second type. Integral formulas. First order differential equations. Higher order linear differential equations. System of differential equations

D. TEXTBOOKS/REFERENCES

1. H. Anton , *Calculus with Analytic Geometry,* John Wiley& Sons; New York, Chichester, Brisbane, Toronto, Singapore, 1998

2. T. Binzar, T. Banzaru, *Integral calculus and differential equations;* Editura Politehnica;Timisoara 2005

3. M. R. Spiegel, *Theory and problems of advanced calculus;* McGraw-Hill Book Company; New York, 1962

MATHEMATICS IV

A. COURSE OBJECTIVES

The assimilation by students of the methods and knowledge of special mathematics used in electronic engineering, civil engineering, mechanics and the ability of using

MATLAB software.

B. COURSE TOPICS

Complex functions: Elementary complex functions. Holomorphic functions; Curve integral in the complex plane; Series expansions; Residues; Applications of Residues theorem.

Integral operators: Fourier Transform; Laplace Transform; Z Transform.

Distributions: Definition of the distribution; Remarkable examples; Operations with distributions; Tempered distributions.

Probability and stochastic processes: Probability spaces; Random variables; Stochastic processes-Markov chains, Poisson processes; Time series – white and colored noises; Diffusion processes; Mathematical statistics;

C. APPLICATIONS TOPICS (laboratory, seminar)

At the seminars, applications corresponding to the course subjects are presented.

Laboratories: **Numerical methods. Probability and stochastic processes in MATLAB**: Numerical solutions for nonlinear equations; Numerical integration; Numerical solutions for differential equations; Interpolation and approximation functions; Classical schemes; Descriptive statistics; Random variables generation; Simple paths for stochastic processes;.

D. TEXTBOOKS/REFERENCES

1. P.Naslau, R.Negrea, L.Cadariu, B. Caruntu, s.a., *Mathematics assisted by computer*; Editura Politehnica, Timisoara, 2005 (2nd ed.2006, 3rd ed. 2007) (in Romanian).
2. P. Gavruta, R. Negrea, L. Cadariu, L. Ciurdariu, *Mathematics for engineerings*; Editura Politehnica, Timisoara, 2008. (in Romanian).
3. http://ocw.mit.edu/OcwWeb/Mathematics/

MATERIALS SCIENCE

A. COURSE OBJECTIVES

This course provides fundamental understanding in materials for electronics. Students will learn the essentials of the electronics properties of materials. A special attention will be paid to understand practical aspects and applications of these materials.

B. COURSE TOPICS

Dielectric Materials. Definitions and General Relations. The dielectric constant. Dielectric losses. Dielectric Strength. Technical Materials. Dielectrics for Capacitors. Piezoelectric Materials. Liquid-Crystals. **Magnetic materials**. . Definitions and General Relations. The Hysteresis Loop. The Magnetic Permeability. Magnetic Losses. Technical Materials. Inductor and Transformer Cores Materials. Permanent Magnet Materials. Materials for Magnetic Recording. **Conductor Materials**. Definitions and General Properties. Theory of Superconductivity. Technical Materials. Conductor Types. Materials for Resistors. Technical superconductor materials. **Semiconductor Materials**. Definitions and General Relations. Conduction in Semiconductors. Fermi Level. Current Density. Hall Effect. Semiconductors Manufacturing. Microelectronic Circuit Element. Technical Materials

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Properties of Dielectric Materials. Properties of Magnetic Materials. Semiconductor

Materials. Resistors. Capacitors. Inductors.

D. TEXTBOOKS/REFERENCES

1. J.D. Livingstone, Electronic Properties of Engineering Materials; Wiley, Massachusetts Institute of Technology, Cambridge, 1999
2. 2 .D. Jiles, Introduction to the Electronic Properties of Materials, Chapman & Hall, London, 1994
3. W. Bolton, Electrical and Magnetic Properties of Materials, Longman Scientific & Technical, Essex, 1992

PHYSICS

A. COURSE OBJECTIVES

To build a foundation for future study. To understand the conceptual notions of elementary physics. To know common situations when physics is useful and to apply it. To have a founded confidence about problem solving abilities using basic physics knowledge.

B. COURSE TOPICS

Mechanics. Basic concepts. Statics and dynamics. Kinematics.

Thermodynamics. Basic terms. Principles of thermodynamics. Thermal equilibrium. Heat transfer.

Electricity. Basic concepts. Elementary electrical circuits. DC and AC analysis.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Working problems and reviewing material according to the course.

D. TEXTBOOKS/REFERENCES

1. V. Dorobantu, S. Pretorian – Physics between fear and respect, Politehnica Publishing House, Timisoara, 2007

ELECTRONIC DEVICES

A. COURSE OBJECTIVES

This course provides fundamental understanding and engineering experience in electronic devices. Students will learn the essentials of the electronic devices, with emphasizes on diodes and transistors. Also some of the high-power switching devices are presented: silicon-controlled rectifier, diacs and triacs. A special attention will be paid to simulate and experiment the behaviour of electronic devices, using the tools and techniques used by practicing electronic engineers.

B. COURSE TOPICS

1. INTRODUCTION

2. SEMICONDUCTOR FUNDAMENTALS (The Bohr Model of the Atom, Band Theory of Solids, Conductors, Semiconductors and Insulators, Intrinsic and Extrinsic Semiconductors, Carrier Transport).

3. THE PN JUNCTION (Fabrication and Structure of the pn Junction, Thermal Equilibrium, The Biased pn Junction, Junction Characteristic, Dynamic Regime of the pn Junction, Small and Large Signal pn Junction Model).

4. DIODES (Common Diode Applications, Types of Diodes).

5. BIPOLAR JUNCTION TRANSISTORS (Construction and Symbols, Operating Modes, Connections and i-u Characteristics, The Physical Behaviour of a BJT. Current Relationship, Ebers-Moll Model, The BJT Transistor Current-Voltage Characteristics, BJT Large Signal/DC Model, BJT biasing circuits, BJT Small

Signal/AC Model).
6. FIELD EFFECT TRANSISTORS (JFET Structures and Symbols, Physical Behaviour and Modes of Operation, Parameters, Characteristics, DC/Large Signal Model, Biasing, AC/Small Signal and Midband Frequency Model, Small Signal, High Frequencies JFET Model, MOSFETs).
7. HIGH-POWER SWITCHING DEVICES (Silicon-Controlled Rectifier, Diacs, Triacs).

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratories: Diodes - characteristics and applications, Bipolar transistor (DC characteristics, small signal AC parameters), J-FET and MOS-FET transistors (DC characteristics, small signal AC parameters, applications).

Tutorials: the subjects of tutorials will include problems close related to the topics of the course.

D. TEXTBOOKS/REFERENCES

1. Thomas L. Floyd, "Electronic Devices", Electron Flow - Fifth Edition, USA, Pearson/Prentice Hall, 2005.
2. Jimmie J. Cathey, "Theory and Problems of Electronic Devices and Circuits", Second Edition, McGrow-Hill, 2002.
3. C.D. Căleanu, V. Tiponuţ, A. Filip, V. Maranescu, "Electronic Devices", to appear in Politehnica Publishing House, 2009.

APPLIED COMPUTER PROGRAMMING

A. COURSE OBJECTIVES

The present course focuses on fundamental concepts in web programming and provides knowledge and skills about the development of medium-level complexity programs in HTML language (which is the fundamental language of the World Wide Web).

B. COURSE TOPICS

1. Introduction to HTML
2. HTLM basic elements
3. Lists
4. Tables
5. Links
6. Images
7. Sounds and videos
8. Frames
9. Forms
10. Cascading style sheets
11. Javascript

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

During laboratories the students will solve specific HTML applications, according to the theoretical notions studied in the courses.

D. TEXTBOOKS/REFERENCES

1. Ian GRAHAM: "Introduction to HTML", 2000, http://www.utoronto.ca/webdocs/HTMLdocs/NewHTML/htmlindex.html
2. Ionel SIMION: "Proiectarea paginilor web", Editura Teora, Bucuresti, 2005

3. http://www.landofcode.com/html/

ELECTRONIC CIRCUITS

A. COURSE OBJECTIVES

Theoretical and practical introduction to electronic circuits. Study of amplifiers and oscillators circuits. Theory of negative feedback, stability and frequency compensation.

B. COURSE TOPICS

Amplifier in DC regime.

Frequency response of an amplifier. Bode plots, OCTC, SCTC analysis methods. Miller effect and theorem.

Feedback in amplifier and circuit design. Uses of basic feedback topologies for amplifiers. Loop gain determination.

Noise sources in amplifiers.

Stability analysis for amplifiers. Frequency compensation.

Multistage amplifiers.

Output amplifier stages: Push-pull stage: Crossover distortion. Biasing considerations. Thermal considerations.

High efficiency output stages. Class D output stage: structure and topologies.

Positive feedback and Oscillators.

C. APPLICATIONS TOPICS (LABORATORIES)

The Amplifier in DC regime. Amplifier frequency response. Negative feedback effects. Amplifiers frequency compensation. Push-pull stage. Wien oscillator & LC oscillators.

D. REFERENCES

1. P.R. Gray, P. Hurst, S. Lewis, R. G. Meyer, *"Analysis and Design of Analog Integrated Circuits"*, 4th Edition, January 2001
2. V. Tiponut, *Dispozitive si circuite electronice* (note de curs - format electronic); "Politehnica" Univ. of Timişoara, 2003.
3. A. Filip, *Circuite Electronice Fundamentale, Aplicaţii* (note de seminar – format electronic), "Politehnica" Univ. of Timişoara, 2007.

ENGINEERING ELECTROMAGNETICS

A. COURSE OBJECTIVES

This course represents an introduction to Engineering Electromagnetics, which constitutes one of the basic topics for the electronic and electric engineer. The physical laws of electromagnetism-the so called Maxwell's equations- are stated. Based on these equations, some further concepts and computation methods for stationary fields are developed. Elements of electromagnetic waves and transmision lines are introduced. These are prerequisites for the more advanced courses like high frequency technique, electromagnetic compatibility, radiocommunications, sensors and transducers, etc.

B. COURSE TOPICS

Scalar and Vector fields: scalar field, vector fields, line and surface integrals of vector fields, divergence and curl of vector fields, Gauss and Stokes theorems, some useful vectorial identities.

Maxwell's equations in free space: electric charge and currents, electric and

magnetic fields as force fields (Lorenz's force law), Gauss's law for the electric field , Gauss's law for the magnetic field, magnetic circuit's law, Faraday's law, electric charge conservation law.
Maxwell's equation in material media: electric fields in conductors and the electrical conduction law, Joule-Lenz law, dielectrics in electric fields and the temporary polarization law, media in magnetic fields and the temporary magnetization law, Maxwell's equations in material media, boundary conditions.
Static electric fields: Maxwell's equations for static electric fields, electric scalar potential, Poisson and Laplace's equations, electric capacity, electrostatic energy and forces,
Stationary electric fields: Maxwell's equations for stationary electric fields in conductive media, electric resistance, resistance-capacitance analogy, relaxation theorem.
Stationary and quasistationary magnetic fields: Maxwell's equations for time-invariable magnetic fields, magnetic vector potential, Poisson's equation, Biot-Savart's law, inductivities, magnetic energy and forces, magnetic circuits, permanent magnets.
Uniform plane electromagnetic waves in material media: waves in loss-les media, waves in lossy media, normal incidence of waves on plane interfaces.
Radiation of electromagnetic waves: retarded electromagnetic potentials, radiation of the hertzian dipole, linear antennas, array of linear antennas.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratory works:

1. Introduction to finite element method (FEM).
2. Physical modeling of static electrical fields. Modelization (FEM) of the same problem.
3. Physical modeling of static electrical fields. Modelization (FEM) of the same problem.
4. Faraday's law. Mutual inductance. Magnetic levitation. Computer visualization of the same problems.
5. Ampere's law for magnetic circuits. Linearity, nonlinearity, air gap in magnetic circuits. Magnetic permeability. Field representation on computer FEM program, for the same problems.
6. Electromagnetic forces. Computer modelization.
7. Final review of the homeworks. Individual discussions.

Tutorials:

1. Scalar and vector fields
2. Application of Maxwell's laws in free space
3. Material media in electric and magnetic fields
4. Static and stationary electric fields
5. Stationary magnetic fields
6. Electromagnetic waves 1
7. Electromagnetic waves 2

D. TEXTBOOKS/REFERENCES

1. Engineering Electromagnetics , William Hayt Jr, John A. Buck 6th Edition ("Politehnica" library or downloadable)
2. Electromagnetic fields and energy (MIT, downloadable).

3. Introductory Electromagnetism, University of Tennessee (downloadable)

SIGNALS AND SYSTEMS

A. COURSE OBJECTIVES

This course is frequently found in electrical engineering curricula, the concepts and techniques that form the core of the subject are of fundamental importance in all engineering disciplines. Our approach has been guided by the continuing developments in technologies for signal and system design and implementation, which made it increasingly important for a student to have equal familiarity with techniques suitable for analyzing and synthesizing both continuous-time and discrete-time systems.

B. COURSE TOPICS

1. Signals and systems: Introduction; Continuous-Time and Discrete-Time Signals; Exponential and Sinusoidal Signals; Continuous-Time and Discrete-Time Systems; Basic System Properties.

2. Linear time-invariant systems: Discrete-Time LTI Systems: The Convolution Sum; Continuous-Time LTI Systems: The Convolution Integral; Properties of Linear Time-Invariant Systems; Singularity Functions.

3. Fourier Series Representation: The Response of LTI Systems to Complex Exponentials; Fourier Series Representation of Continuous-Time and Discrete-Time Periodic Signals.

4. The Continuous-Time Fourier Transform: Representation of Aperiodic Signals: The Continuous-Time Fourier Transform; Properties of the Continuous-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Differential Equations.

5. The Discrete-Time Fourier Transform: Representation of Discrete-Time Aperiodic Signals: The Discrete-Time Fourier Transform; Properties of the Discrete-Time Fourier Transform; Duality; Systems Characterized by Linear Constant-Coefficient Difference Equations.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Signals and systems: problems. **Linear time-invariant systems:** problems. **Fourier Series Representation:** problems+laboratory experiments (Continuous-Time Periodic Signals Frequency Analysis). **The Continuous-Time Fourier Transform:** problems+laboratory experiments (Second Order Continous-Time Systems Analysis). **The Discrete-Time Fourier Transform:** problems+laboratory experiments (FIR Systems Simulation).

D. TEXTBOOKS/REFERENCES

1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, Signals & Systems, Second Edition, Prentice Hall, Upper Saddle River, New Jersey, 1997, ISBN 0-13-814757-4.
2. Simon Haykin, Barry Van Veen, Signals and Systems, 2nd edition, John Wiley & Sons, 2003

DIGITAL INTEGRATED CIRCUITS

A. COURSE OBJECTIVES

The goal of the course is to introduce the main Digital Integrated Circuits, starting with the simplest logic gates and ending with memories. Design principles and

common applications will be covered.

B. COURSE TOPICS

1. Logic Gates and Boolean Algebra (numerical representations, digital number systems, hexadecimal number system, Boolean algebra, logic gates).
2. Integrated-Circuit Logic Families (CMOS, HCMOS, LS-TTL, BiCMOS, characteristics, schematics, applications).
3. Combinational Logic Circuits (decoders, encoders, multiplexer, demultiplexer, comparators, adders, parity generators – characteristics, schematics, extensions, typical applications).
4. Flip-Flops and Related Devices (SR, JK, D, T, one-shots, oscillators, clock generators, - schematics, applications).
5. Counters and registers (types, classification, schematics, and applications).
6. Memories (EPROM, EEPROM, FLASH); RAM (SRAM, DRAM) - characteristics, applications.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

1. Measuring instruments (digital multimeter, digital oscilloscope, logic analyzer, function generator).
2. The VK diagram. Applications.
3. TTL ICs – characteristics, parameters.
4. CMOS ICs – characteristics, parameters.
5. Decoders and demultiplexers.
6. Encoders and Multiplexers.
7. Magnitude comparators and adders.
8. Flip-flops.
9. One-shots and oscillators.
10. Registers.
11. Counters and frequency dividers.
12. ROM Memories.
13. RAM Memories.

D. TEXTBOOKS/REFERENCES

1. Wakerly J., Digital Design: Principles and Practices, Prentice Hall, 2005
2. Tocci R., Widmer N., Digital Systems, Principles and Applications, Eighth Edition, Prentice Hall, 2001.

COMPUTER AIDED DESIGN

A. COURSE OBJECTIVES

The **objective** of the course is to introduce the students to modeling and simulation of electronic circuits in a timely manner. Attendees will gather a general understanding of the computer design tools such that these skills be used in all courses covering special topics on electronic circuits in the later year of study.

B. COURSE TOPICS

1.Course objective presentation. Device and Circuits models.
- SPICE models, Switch level models for CMOS

2. Entry Level Tools. OrCAD and Mentor Graphics
- Schematic Entry, State Diagrames and Ecuations

3. PCB Design

- Partitioning using chain/tree, auto route startegies

4. HDL Representations of Circuits (VERILOG)
- Functional/structural descriptions, simulation control (#, @)

5. FEM Field Modeling. MathLab simulation Tools
- FEM method outline. Segmentation. MathLab introduction. Simulink

C. APPLICATIONS TOPICS

1. Models, libraries and technology files. IRSIM example
2. OrCAD Schematic entry, flat, hierarchy designs (diagrams)
3. Mentor Graphics simulation
4. PCB design project.
5. Verilog descriptions examples. Active-VHDL simulation.
6. Qfield FEM case study.

D. REFERENCES (electronic form – intranet, printed form – CAD Lab)

1. OrCAD Manuals OrCAD
2. Mentor Graphics Users Manual. Tutorials Mentor Graphics

ELECTRICAL AND ELECTRONIC MEASUREMENTS

A. COURSE OBJECTIVES

Basic knowledge on methods and devices to provide the skills and abilities for performing accurate measurements.

B. COURSE TOPICS

Basic knowledge on metrology. Measuring devices, measuring methods. Characteristics of measuring instruments. Electronic circuits in measuring instruments. Amplifiers. Digital to analog converters. Analog to digital converters. Measurement errors and uncertainties. Random errors, bias, outliers. Grubbs' test for outliers. Expanded uncertainty. Confidence interval and confidence level. Error propagation. Current measurement. Voltage measurement. Frequency measurement. Power and energy measurement.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Current measurement. Voltage measurement. Frequency measurement. Power and energy measurement. Multimeters. Oscilloscopes

D. TEXTBOOKS/REFERENCES

1. J. G. Webster (Editor in chief) – Measurement, instrumentation and sensors handbook, CRCnetBase 1999

ANALOG INTEGRATED CIRCUITS

A. COURSE OBJECTIVES

This course is concerned largely with the analysis and design of ICs, a considerable amount of material is also included on applications. The main purpose is to present the basic building blocks in modern analog IC design, the design of operational amplifiers and their linear and nonlinear applications. So, the section on two-transistor amplifiers has the greatest emphasis on differential pairs. The important topics of current mirrors, band-gap references and active loads are considered. A large chapter deals with the design of operational amplifiers (op amps) with illustrative examples of dc and ac analysis, and the limitations of the basic op amps are also described. The frequency response of amplifiers is considered.

B. COURSE TOPICS

1. Bipolar, MOS, and BiCMOS Integrated-Circuit Technology. Introduction
2. Multiple-Transistor Amplifier Stages
2.1. The CC-CE, CC-CC, and Darlington Configurations
2.2. The Cascode Configuration. The Bipolar Cascode
2.3. Differential Pairs
2.3.1. The dc Transfer Characteristic (of an Emitter-Coupled Pair, with Emitter Degeneration, of a Source-Coupled Pair)
2.3.2. Introduction to the Small-Signal Analysis of Differential Amplifiers
2.3.3. Device Mismatch Effects in Differential Amplifiers
3. Current Mirrors, Active Loads, and References.
3.1. Simple Current Mirror
3.2 Simple Current Mirror with Beta Helper
3.3.Simple Current Mirror with Degeneration
3.4.Cascode Current Mirror
3.5.Wilson Current Mirror
3.6. Active Loads. Common-Emitter/Common-Source Amplifier with Complementary Load
3.6.1. Differential Pair with Current-Mirror Load. Large-Signal Analysis
3.6.2. Differential Pair with Current-Mirror Load. Small-Signal Analysis
3.6.3. Differential Pair with Current-Mirror Load. Common-Mode Rejection Ratio.
3.7. Voltage and Current References.
3.7.1. Bipolar Widlar Current Source
3.7.2. Bipolar Peaking Current Source
3.7.3. Supply-Insensitive Biasing
3.7.4. Temperature-Insensitive Biasing. Band-Gap-Referenced Bias Circuits in Bipolar Technology
4. Operational Amplifiers with Single-Ended Outputs. Basic Feedback Concepts
4.1. Operational Amplifiers with Single-Ended Outputs. Linear Applications of Operational Amplifiers
4.2. Operational Amplifiers with Single-Ended Outputs. Nonlinear Analog Operations.
4.3. Nonlinear Analog Circuit. Precision Rectification
4.4. Deviations from Ideality in Real Operational Amplifiers.
4.5. Bipolar Operational Amplifiers
4.6. The dc Analysis of the 741 Operational Amplifier
5. Frequency Response of Integrated Circuits
5.1. Single-Stage Voltage Amplifiers and the Miller Effect
5.2. Analysis of the Frequency Response of the 741 Op Amp.
5.3. Analysis of the Frequency Response of the 741 Op Amp. Calculation of the - 3-dB Frequency of the 741.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

1. The scope and function generator
2-3. The BJT differential pair. Experiment and simulation
4-5. Operational amplifier basics
6. The precision rectifier with operational amplifier.

D. TEXTBOOKS/REFERENCES

PAUL R. GRAY, PAUL J. HURST, STEPHEN H. LEWIS, ROBERT G. MEYER, *Analysis And Design Of Analog Integrated Circuits*, Fourth Edition, JOHN WILEY & SONS, 2001

LUCIAN JURCA, MIRCEA CIUGUDEAN, *Circuite integrate analogice*, Editura "Politehnica", Timişoara, 2006.

MICROECONOMICS

A. COURSE OBJECTIVES

The purpose of the course is to conduct the student through an account of the central canon of microeconomics, showing how it can assist in understanding everyday economic phenomena and helping in developing a flair for economic reasoning.

B. COURSE TOPICS

The firm. The optimisation problem. The firm as a black box. The multiproduct firm.

The firm and the market. The market supply curve. Interaction between firms. The size of the industry. Price-setting. **The consumer.** The consumer's environment. Revealed preference. Consumer optimisation: fixed income. Welfare.

The consumer and the market. The market and incomes. Supply by households. Household production.

A simple economy. Another look at production. The Robinson Crusoe economy. Decentralisation and trade.

General equilibrium. A more interesting economy. The logic of price-taking. The excess-demand approach.

Uncertainty and risk. Consumption and uncertainty. Risk aversion. Trade.

Welfare. The constitution. The social welfare function.

Strategic behaviour. Games – basic concepts. Equilibrium. Application: duopoly. Time. Application: market structure.

Government and the individual. Market failure? Nonconvexities. Externalities. Public consumption.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Tutorial topics are the same as for the course.

D. TEXTBOOKS/REFERENCES

1. F. A. Cowell – Microeconomics. Principles and analysis, London School of Economics, 2004

COMPUTER NETWORKS ARCHITECTURE

A. COURSE OBJECTIVES

The course examines the conceptual framework for specifying a computer network - the network architecture, and investigates the set of rules and procedures that mediate the exchange of information between two communicating processes - the network protocols.

B. COURSE TOPICS

Module 1: **Introduction to computer networking:** Network hardware, Network software, Reference models.

Module 2: **The physical layer:**The theoretical basis for data communication, Guided transmission media, Wireless transmission, Communication satellites;
Module 3: **The data link layer:**Data link layer design issues, Error detection and correction, Elementary data link protocols
Module 4: **The medium access sublayer:** The channel allocation problem, Ethernet, Data link layer switching;
Module 5: **The network layer**
Module 6**: The transport layer** The transport service, Elements of transport protocols
Module 7: The application layer: **DNS--domain name system, Electronic mail**

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Lab 1: Monitoring internet services. Telnet (SSH), E-mail, FTP; Lab2: Monitoring Internet Connections (TCP/IP). Traffic shaping; Lab3: Configuring Ethernet Networks; Lab 4: Mac and IP Adresses; Lab 5: Capturing and monitoring the network traffic; S1 „TCP Connections"; S2 „IP Addressing"; S3 „Subneting"
At the end of each lab the students will prepare a short test showing their achieved results. Each test will be graded.

D. TEXTBOOKS/REFERENCES

1. Andrew S. Tanenbaum, *Computer Networks*, Fourth Edition Prentice Hall, 2003, ISBN 0-13-066102-3
2. Raghavan R. V., Jain B. N., *Computer Networks, Architecture and Applications*, Chapman and Hall
3. Hura and Shingal, *Data and Computer Communications*, CRC Press 2001.

OBJECT ORIENTED PROGRAMMING

A. COURSE OBJECTIVES

The present lecture focuses on fundamental concepts in object-oriented analysis and design and provides knowledge and skills about the development of medium-level complexity programs in Java programming language.

B. COURSE TOPICS

1. Fundamental concepts in Object-Oriented Programming
2. Introduction to classes and objects
3. Controlling program flow
4. Initialization and cleanup
5. Reusing classes: inheritance
6. Polymorphism
7. Hiding the implementation: packages and interfaces
8. Holding the objects: arrays and containers
9. Error handling with exceptions
10. The Java IO System
11. Creating Windows applications and applets. Graphic interfaces.
12. Threads in Java

C. APPLICATIONS TOPICS (laboratories, seminars, projects)

During laboratories the students will solve specific Java applications, according to the theoretical notions studied in the lecture. They will learn how to create and run Java stand-alone applications and applets and how to deal with object oriented

aspects like inheritance, polymorphism, interfaces, error handling and exceptions and threads.

D. TEXTBOOKS/REFERENCES

1. B. Eckel. *Thinking in Java. 3rd Edition.* Prentice-Hall, 2002.
2. D.J. Eck. *Introduction to programming using Java. 5th Edition.* 2006, http://math.hws.edu/javanotes/.
3. *** *The Java tutorials.* http://java.sun.com/docs/books/tutorial/index.html

SIGNAL PROCESSING

A. COURSE OBJECTIVES

The concepts and techniques that form the core of the subject are of fundamental importance in all engineering disciplines. Our approach has been guided by the continuing developments in technologies for signal and system design and implementation, which made it increasingly important for a student to have equal familiarity with techniques suitable for processing both continuous-time and discrete-time systems.

B. COURSE TOPICS

1. Time and Frequency Characterization of Signals and Systems: The Magnitude-Phase Representation of the Fourier Transform, First-Order and Second-Order Continuous-Time and Discrete-Time Systems.

2. Sampling: Representation of a Continuous-Time Signal by Its Samples. The Sampling Theorem. Reconstruction of a Signal from Its Samples using Interpolation. Sampling of
Discrete-Time Signals.

3. Modulation: Complex Exponential and Sinusoidal Amplitude Modulation, Pulse Amplitude Modulation, Sinusoidal Frequency Modulation, Discrete-Time Modulation.

4. The Laplace Transform: The Region of Convergence for Laplace Transforms, Properties of the Laplace Transform, Analysis and Characterization of LTI Systems Using the Laplace Transform.

5. The z Transform: The Region of Convergence for the z- Transform, Properties of the z-Transform, Analysis and Characterization of LTI Systems Using the z-Transform.

6. Linear Feedback Systems: Some Applications and Consequences of Feedback, Root-Locus Analysis of Linear Feedback Systems, The Nyquist Stability Criterion, Gain and Phase Margins.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Time and Frequency Characterization of Signals and Systems: problems + laboratory experiments (Passive and Active Filters).

Sampling: problems + laboratory experiments (Continuous-Time Signals Sampling).

Modulation: problems + laboratory experiments (Frequency and Amplitude Modulation of Continuous-Time Signals).

The Laplace Transform: problems

The z Transform: problems

Linear Feedback Systems: problems + laboratory experiments (The Prediction of

Gain and Phase Margins of Different Continuous-Time Systems).

D. TEXTBOOKS/REFERENCES

1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, Signals & Systems, Second Edition, Prentice Hal, Upper Saddle River, New Jersey, 1997, ISBN 0-13-814757-4.

2. Simon Haykin, Barry Van Veen, Signals and Systems, 2nd edition, John Wiley & Sons, 2003

MICROPROCESSORS AND MICROCONTROLLERS

A. COURSE OBJECTIVES

- to present basic knowledge of these devices
- to present arguments for the importance and the necessity of the Microprocessors
- to introduce general long time valuable issues and characteristics of these devices' family
- Power Point presentations and interactive discussions during the courses

B. COURSE TOPICS

- The microprocessor and the microcontroller: basic architecture, basic functioning principles;
- Concrete examples on the 8051 general use microcontroller and on the HCS 12X Siemens microprocessor;
- Programming in assembling language;
- Microprocessors programming in C/C^{++};
- PIC16 F452 microcontrollers;
- 8086 microprocessor family;
- 32-bit architectures;
- AMD Athlon 64 FX-55 Processor.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

At the laboratory works has the students will focus on more specific details of the HCS 12X Siemens microprocessor;

D. TEXTBOOKS/REFERENCES :

1. Rodnay Zaks, Intoduction to microprocessors, Sybex Inc, Berkley CA USA, 1999, ISBN: 0- 89588-010-5

2. Hosein Sabaghian Bidgoli, 8051 Microcontroller, Kashan University, 2005, http://ce.kashanu.ac.ir/sabaghian/micro/Micro_Spring2005.htm

3. Liviu Toma et al, Microcontrolere HCS12X, Teorie si aplicatii, Editura de Vest, Timisoara, 2008, ISBN: 978-973-36-0481-5 (translation in work).

ELECTRONIC CIRCUITS PROJECT

A. COURSE OBJECTIVES

The project accustoms the students with specific problems concerning the design and realization of an electronic circuit.

B. COURSE TOPICS

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C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Students will design, simulate, make the layout, mount the parts, test, measure and complete a report on an electronic circuit (frequency divider, frequency counter,

alarm circuit, watch, digital voltmeter)

D. TEXTBOOKS/REFERENCES

1. A. Gontean – Digital Integrated Circuits, Politehnica Publishing House, Timişoara, 2007.

CURRICULUM

Major: Electronics and Telecommunications - Bachelor Studies inEnglish

Nr crt	Discipline	C	S	L	P	Cr./Ex*
IIIrd Year 5th Semester						
1	Management and Marketing	2	2	0	0	4/D
2	Electronic Instrumentation	2	0	2	0	4/E
3	Radio Communications	2	0	2	0	4/D
4	Virtual Instrumentation	2	0	1	1	4/E
5	Information Theory and Coding	2	1	1	0	4/D
6	Data Communications	2	0	2	0	4/E
7	High Frequency Techniques	2	0	2	0	4/E
8	Practical Training (45 hours)	0	0	0	0	2/C
	Total	**14**	**3**	**10**	**1**	**30**
IIIrd Year 6th Semester						
1	Optional Topic 1	2	0	2	0	4/E
2	Programmable Logic Systems	2	0	1	1	5/D
3	Power Electronics	2	0	2	0	4/E
4	Embedded Systems	2	0	2	0	4/E
5	Digital Telephony	2	0	2	0	5/E
6	Audio and Video Systems	2	0	2	0	4/D
7	Engineering Ethics and Communication	1	1	0	0	2/D
8	Practical Training (45 hours)	0	0	0	0	2/C
	Total	**13**	**1**	**11**	**1**	**30**
IVth Year 7th Semester						
1	Electronic Equipment Testing	2	0	2	0	5/E
2	Software Development	2	0	1	1	5/D
3	Modeling and Simulation	2	0	1	1	5/E
4	Optional Topic 2	2	0	2	0	4/E
5	Microelectronics	2	0	2	0	5/D
6	Integrated Digital Networks	2	0	2	0	4/E
7	Project (Optional Topic 2)	0	0	0	2	2/D
	Total	**12**	**0**	**10**	**4**	**30**
IVth Year 8th Semester (7 weeks + 7 weeks diploma preparation)						
1	Optional Topic 3	3	0	3	0	3/E
2	Optional Topic 4	3	0	3	0	3/E
3	Electronic Packaging	3	0	3	0	3/E
4	Wireless Communications	3	0	3	0	3/E
5	Software Project	0	0	0	3	3/D
6	DIPLOMA PROJECT					15
	Total	**12**	**0**	**12**	**3**	**30**

Legend

C	S	L	P	Cr/Ex*
Course	Seminar	Laboratory	Project	Credits/Examination form

* Evaluation form: E = exam; D = distributed evaluation; C = colloquium

Optional Topic 1	• Electromagnetic Compatibility • Digital Switching Systems

Optional Topic 2	• VHDL • Digital Signal Processors

Optional Topic 3 Optional Topic 4	• Digital Radio Communications • Optical Communications • Image Processing • Biomedical Electronics

MANAGEMENT AND MARKETING

A. COURSE OBJECTIVES

The discipline objectives provide skills for business and life adeptness by using methods and techniques for strategic planning, organizing, leading, business evaluation and adjusting, respectively, principles for the classification and optimization of the newly appeared economic phenomena, there being developed the marketing concept.

B. COURSE TOPICS

The Concept of Management - the evolution of modern management.**The function of planning - t**he strategic planning **The function of organizing -**the design of the organizing structure, the job designing, compartments making. **The function of personnel leading** - the situational theory. **The training function** – communication, motivation, communication skills, win-win relation. **Marketing** – general concept, the marketing function, the marketing mix-planning and achievement of the conceiving, price establishing, promotion, and distribution. Marketing strategic plan.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

The planning algorithm, Gantt chart.
Resources assignment, Resources leveling.
Team building workshop.
Negotiation workshop.
Win-Win relation.
Price establishing techniques.
Brainstorming
Designing a promotion clip.

D. TEXTBOOKS/REFERENCES

1. http://www.mpt.upt.ro

ELECTRONIC INSTRUMENTATION

A. COURSE OBJECTIVES

Basic knowledge on electronic measuring instrumentation, aimed to provide the skills and abilities for appropriate use in conducting experimental work.

B. COURSE TOPICS

Oscilloscopes. Description and use. Vertical and horizontal deflexion blocks. Time base. Synchronization. Probes.

Signal generators. Sine wave generators: low frequency, radio frequency, microwave. Pulse generators.

Digital voltmeters and multimeters. Measurement techniques and errors. Normal and common mode rejection.

Frequency counters. Universal counters. Microprocessor-based counters. Error reduction.

Spectrum analyzers. Filter bank analyzers. FFT analyzers.

PC-based measuring instrumentation. Basic concepts. User boards. Addressing. Data acquisition systems.

Virtual instrumentation. Basic concepts. Examples.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)
Multimeters. Oscilloscopes. Signal generators. Frequency counters. Spectrum analyzers. Virtual instrumentation.
D. TEXTBOOKS/REFERENCES
1. J. G. Webster (Editor in chief) – Measurement, instrumentation and sensors handbook, CRCnetBase 1999

RADIO COMMUNICATIONS

A. COURSE OBJECTIVES
The lectures contain the basic principles of radio communications. All the elements contributing to a radio link are presented. The functional features are explained together with the main parameters. The theoretical approach is always followed by applications and problems.
B. COURSE TOPICS
1. General considerations about radio communications.
2. Radio wave propagation.
3. Antennas and radiation systems.
4. Analog and digital modulators.
5. RF oscillators and Frequency Synthesis.
6. Radio Receivers, architectures and parameters.
7. Radio Transmitters, architectures and parameters.
8. RF Power Amplifiers.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)
The main laboratory works cover: RF generators, Radio receivers, PLL circuits, Antenna systems (use of real antennas and simulations for 3D behavior study).
D. TEXTBOOKS/REFERENCES
1. **Introduction to RF Propagation**, J.S. Seybold, John Wiley & Sons, 2005, (electronic form).
2. **Modern Antenna Handbook**, C.A. Balanis, John Wiley & Sons, 2008, (1 copy in office).
3. **Wireless Transceiver Design**, A. Luzzatto, G. Shirazi, John Wiley & Sons, 2007, (electronic form).
4. **Radiocomunicatii, (**in romanian**)** E. Marza, F.Alexa, C.Simu, Editura de Vest, Timisoara, 2007, (20 copies in library).

VIRTUAL INSTRUMENTATION

A. COURSE OBJECTIVES
LabVIEW represents graphical programming for data acquisition, instrument I/O, measurement analysis and visualization. LabVIEW can be used to : acquire analog waveforms using a DAQ board, store the waveforms in a file and retrieve them, collect and log temperature data, control an instrument connected to a serial port, acquire waveforms from a serial instrument, control GPIB instrument, acquire waveforms from a GPIB instrument, plot acquired data on strip charts and graphs. Save data in files that you can retrieve with a spreadsheet.
B. COURSE TOPICS
Introduction to LabVIEW: What is a virtual instrument (VI);Working in the

environment;Using the help options in LabVIEW; **Creating and Debugging a VI:** Editing and debugging techniques; Useful tips; **SubVIs-Icons and connectors:**Using VIs as subVIs; Using the Create SubVI menu option; **Loops and Charts:**Acquiring data at timed interval; Displaying data in strip charts; Using shift registers; Performing running averages; **Arrays and Graphs:**Creating arrays on loop boundaries; Understanding polymorphism; Displaying data in graphs; **Case and Sequence Structures:** Conditional execution with Case structures; Using Sequence and Sequence Locals; Directly entering formulas;**Strings and File I/O:**Using string functions; Converting strings and numbers; Reading and writing ASCII data files; Timestamping data; Creating files for spreadsheet use; **VI Options:**Creating pop-up VIs;Controlling VI window functions; **Data Acquisition (DAQ):** Overview of DAQ; The DAQ Channel Wizard; Single-point analog I/O; Timed, multiple-point analog I/O; Performing digital I/O; **Instrument control**: Overview of serial I/O; Overview of IEEE 488 (GPIB); Overview of VISA; Using instrument drivers; **Additional topics:** Continuous data acquisition; GPIB waveform transfers.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratories

Introduction to LabVIEW. Creating, editing and debugging LabVIEW. Creating a subVI. Loops and charts. Arrays and graphs. Case and sequence structures. Strings and file I/O.

Project

Virtual function generator realization. Virtual oscilloscope realization. Virtual spectral analyzer realization. Monitoring multipoint system for temperature control and analysis.

D. TEXTBOOKS/REFERENCES

1. Cottet, F., Ciobanu, O., Bazele programării în LabVIEW, Ed. Matrix Rom, Bucureşti 1998.
2. G Programming Reference Manual. National Instruments, January 200.
3. LabVIEW Function and VI Reference Manual. National Instruments, Jan. 2006.

INFORMATION THEORY AND CODING

A. COURSE OBJECTIVES

The course covers information theory and coding within the context of modern digital communications applications. Advanced topics such as Reed-Solomon codes, space time codes, concatenated codes, turbo coding and LDPC codes are introduced. Bandwidth efficient trellis coded modulation is also overviewed. Important learning components are: homeworks, Matlab computer assignments, and a final project report and presentation.

B. COURSE TOPICS

The course material is divided into ten modules as follow: **Introduction** (overview of Shannon's information theory, the digital communication system); **Selected topics in probability, random variables and processes** (probability, random variables,statistical independence and the Markov property,Gaussian random variables,bounds on tail probabilities,random processes); **Modulation and detection** (digital modulation, optimum detection, detector performance for several

modulation schemes); **Information theory** (discrete sources and coding, channel capacity and channel coding,); **Block codes** (Introduction to block codes, Galois field primer,linear block codes, Hamming codes, cyclic codes, binary linear block code decoding and performance analysis, Reed-Solomon codes, product codes, interleaving, concatenated block codes, space-time block codes); **Optical detectors and receivers** (covers the physics and technology of the detection and demodulation of light, including photoconductors, photodiodes, phototransistors, and receiver systems); **Convolutional codes** (Linear convolutional codes ,transfer function representation and distance properties,decoding convolutional codes, performance of convolutional code decoders, Viterbi algorithm implementation, sequential decoding); **Turbo and LDPC codes**(Decoding algorithms which generate extrinsic information, turbo codes,turbo product codes,turbo equalization, LDPC coding and decoding); **Trellis coded modulation** (trellis coding with higher order modulation, set partitioning,TCM decoding and performance); **Simulation of coding techniques in Matlab** (an overview of the Matlab simulations for information theory and coding).

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

The practical activity is based on the following laboratory exercises:1.Discrete sources coding:Huffman, Shannon-Fano; 2. AWGN dicrete channels; 3. Block Codes:Hamming,cyclic 4. BCH codes; 5. RS codes; 6. Turbo codes. 7. Matlab simulation of coding technics for AWGN discrete chanels.

D. TEXTBOOKS/REFERENCES

1. Teoria statistica a transmisiunii informatiei,by Adrian Mihaescu, Litografia Universitatii Politehnica Timisoara, 1995, (english translation for students use, available in digital form).
2. M. Uro, '' Basic Concepts in Information Theory '', www.citi.int.evry.fr
3. Teoria transmisiunii informatiei,by Adrian Mihaescu, digital course.

DATA COMMUNICATIONS

A. COURSE OBJECTIVES

This aim of this course is to present problems related to the physical layer of RM-OSI-ISO like, channels, distortions, transmission errors, modem-terminal interfaces, modulation techniques and modem structures used in terrestrial networks.

B. COURSE TOPICS

1. Channels: bandwidth, transmission impairments.
2. Digital signals encoding: RZ, NRZ, Manchester, AMI, HDB3, B8ZS. Scramblers.
3. Baseband transmissions. Inter-Symbol Interference (ISI). Nyquist's first theorem. Partial-response systems. Performances improvement: adaptive filtering, eye-diagram, equalization (ZF-zero-forcing). BER-curves. Symbol synchronization.
4. Linear modulation : modulation and demodulation description, errors, ASK modems.
5. Frequency modulation : modulation and demodulation description, errors, FSK modems.
6. Phase modulation : modulation and demodulation description, errors, PSK

modems.

7. DTE/DCE interfaces : V24/RS232C, USB, X21

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

MAC layer in LANs

1. MAC Layer of the Ethernet network .
2. Token-Ring networks.
3. Interconnecting the LANs.

Baseband transmissions (BB)

4. Digital encoding of the baseband signals
5. Baseband transmissions (BB), without Inter-Symbol Interference ISI.
6. Baseband transmissions (BB), with controlled Inter-Symbol Interference ISI

D. TEXTBOOKS/REFERENCES

1. W.Stallings, "Data and Computer Communications", Edit. Prentice-Hall, 1997.
2. I.Nafornita, M. Nafornita, "Telegrafie si transmisiuni de date", IPTVT, 1984.
3. M. Nafornita, C. Munteanu, ''Comunicatii de *date'', Edit. Gh. Asachi, 1996.*

HIGH FREQUENCY TECHNIQUES

A. COURSE OBJECTIVES

Basic knowledge on models and tools for high frequency phenomena and applications.

B. COURSE TOPICS

Transmission lines: Voltage and current waves equations; reflection coefficient and standing wave pattern; input impedance; normalization and the Smith chart; matching; practical transmission lines. **Power transfer on transmission lines:** Maximum power transfer and available power of a generator; conjugate matching. **Scattering parameters:** Definition; reciprocity;lossless multi-ports; one-sided amplifier; examples and applications: phase shifters, directional coupler, hybrid ring, magic Tee. **Microstrip transistor amplifier design:** Microstrip lines; one-sided transistor amplifier; stability and noise. **Microwave devices and circuits:** Filters, matching circuits (broadband and narrow-band), connectors, joints, ferrite (non-reciprocal) devices

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

1. Slotted line measurements: standing wave pattern, wavelength, voltage standing wave ratio.
2. Impedance and reflection coefficient measurement; matching
3. S parameters measurement for two-ports and directional couplers
4. Power measurement
5. Smith chart applications
6. Microstrip transistor amplifier design
7. Spectral analysis

D. TEXTBOOKS/REFERENCES

1. R. E. Collin, *Foundations for microwave engineering*, New York: McGraw-Hill, 1992.
2. D. M. Pozar, *Microwave Engineering*, Second edition, New York: Wiley, 1998.
3. D. M. Sazonov, A. N. Gridin, B. A. Mishustin, *Microwave circuits*, Moscow: Mir, 1982.

ELECTROMAGNETIC COMPATIBILITY

A. COURSE OBJECTIVES

The course acquaints the students with specific problems concerning compliance with electromagnetic compatibility regulations, measurement and testing standards. Regulations concerning the emissive perturbations level and immunity tests for electronic equipments are presented. The discipline assures competence in electromagnetic compatibility regulations implementation, necessary to every electronic engineer for designing, building and using electronic equipment.

B. COURSE TOPICS

1. Introduction. Electromagnetic compatibility directives and regulations.
2. Radiation and conduction transmitted perturbations measurement.
3. Characteristic signals for immunity tests: burst, energetic pulses, ESD.
4. Immunity determination for radiated and conducted perturbations.
5. Immunity tests specific for power supply: power supply variations, dips and interruptions, overvoltage etc.
6. EMC regulations in medicine.
7. EMC regulations in the automotive domain.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

During laboratory classes each student will solve a case study, producing a report for an electronic equipment, concerning all the aspects of electromagnetic compatibility (compliance tests, test methods, description of the equipment used, measurement results).

D. TEXTBOOKS/REFERENCES

1. Ignea, *Electromagnetic compatibility,* West Publishing House, Timişoara, 2007.
2. Ignea, *Telecommunications measurements,* Politehnica Publishing House, Timişoara, 2006.

DIGITAL SWITCHING SYSTEMS

A. COURSE OBJECTIVES

Basic knowledge on digital switching principles and digital switching systems.

B. COURSE TOPICS

Telecommunications networks. Structure, switching function in network, exchange structure, traffic. **Digital Switching.** Time switching, space switching, multiple stage switching networks, blocking probability. **Signaling.** Subscriber line signaling, inter-exchange signaling: ITU-T R2 and ITU-T SS7 signaling systems. **Digital Switching Systems.** Alcatel 1000E10B, Ericsson AXE 10, Siemens EWSD**. Voice over IP.** Structure, protocols overview: RTP/RTCP, H323, SIP, MEGACO. **Intelligent network. Next Generation Network**.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Basic digital switching: time and space switching.
Subscriber line signaling.
Signaling system ITU-T SS7.
Digital exchange Alcatel 1000E10B – logical and hardware structure.
Digital exchange Alcatel 1000E10B – multiprocessor station.
Digital exchange Alcatel 1000E10B – switching matrix.
Asterisk based VoIP system.

D. TEXTBOOKS/REFERENCES

1. J. Bellamy, Digital Telephony, Third Edition, John Wiley and Sons, 2000

PROGRAMMABLE LOGIC SYSTEMS

A. COURSE OBJECTIVES

The goal of the course is to design, simulate, debug and implement a complete digital system in an FPGA. Design principles and common applications will be covered.

B. COURSE TOPICS

1. Special programmable memories (Serial EEPROM, Flash, DDRAMs) - characteristics, applications.
2. History of programmable logic devices. PALs, PLAs, CPLDs, FPGAs, ASICs.
3. Programming technologies: fuse, antifuse, EEPROM, FLASH, RAM.
4. Programmable Logic Systems Architecture. CompactRio. LV FPGA
5. Design styles: schematic, VHDL, transition lists.
6. Design Software. Design for testability. VHDL Basics.
7. Systems on Chip. Microcontrollers and FPGAs.
8. Manufacturing cost analysis (involving FPGAs)

C. APPLICATIONS TOPICS

Laboratory

1. Electronic Instrumentation (digital multimeter, programmable digital oscilloscope, logic analyzer, programmable function generator). Introduction to ISE 10.1 software.
2. Xilinx - Spartan 3 development board overview.
3. Schematic design and simulation using the Spartan 3 demo board.
4. VHDL programming. Examples.
5. 7 digits LED displays multiplexing. Stop watch.
6. Programmable Frequency Divider.
7. FSM example. Traffic Light Control.
8. Custom Color Image on TV Monitor Generation.

Project

1. Frequency meter in FPGA, based on Spartan 3 demo board. 2. PicoBlaze (8 bits) controller in FPGA. 3. Train traffic Control in FPGA. 4. Video Game in Spartan 3. 5. Direct Digital Frequency Synthesis with FPGA. 6. Elevator control in FPGA. 7. FPGA implemented fast logarithmic processor.

D. TEXTBOOKS/REFERENCES

1. Hwang E. O., Digital Logic and Microprocessor Design With VHDL, Brooks – Cole, 2005, ISBN 0-534-46593-5
2. Perry D., VHDL Programming by Example, McGraw-Hill, 2002, ISBN 0-07-140954-8.

POWER ELECTRONICS

A. COURSE OBJECTIVES

Fundamentals of power electronics with emphasis on switching converters are introduced, and then treated in sufficient depth so that students acquire the knowledge and skills needed to design practical power electronics systems.

B. COURSE TOPICS

Elements and principles of power electronics and power quality. Power processing architectures and converter categories. Power factor and total harmonic distortion. Inductor volt-second balance and capacitor charge balance. **Line commutated rectifiers**. Single-phase rectifiers: continuous conduction mode, discontinuous conduction mode, behaviour when C is large, minimizing THD for small C. Three-phase rectifiers: simple and bridge topologies, inductive and capacitive load, effect of commutation inductances. Phase control. Inverter mode. **Basic switching converter topologies**. Duty cycle control. Buck converter, synchronous rectifier. Boost, buck-boost and Ćuk dc-dc converters in CCM and DCM. Effect of nonideal components. **Transformarized switching converters**. Flyback converter. Full-bridge and half-bridge isolated buck converters. Forward converter: transformer reset mechanism, two-transistor forward converter. Push-pull converter. Boost-derived isolated topologies. Isolated Ćuk converter. **Switching converters transfer functions.** State-space models, averaging, linearisation, controller design. **Current programmed control**. Oscillation for D>0.5. Compensation with external ramp. Dead-beat control. **Active power factor correction circuits**. Realisation of near-ideal rectifier. Control of the current waveform. Boost CCM and flyback DCM PFC circuits.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Power semiconductor devices. Single phase and three phase line commutated uncontrolled rectifiers. Filtering. Phase controlled rectifiers. The buck and the forward converters. The boost converter. The buck-boost and flyback converters.
The Ćuk converter. Current-mode control. DCM flyback based power factor correction circuit.

D. TEXTBOOKS/REFERENCES

1. Erickson, R. W., Maksimović, D., "Fundamentals of Power Electronics – second edition", Kluwer Academic Publishers, 2001.
2. Ang, S., Oliva, A., "Power-Switching Converters", Second Edition, CRC Press, Taylor and Francis Group, 2005.
3. Mohan, N., Undeland, T., Robbins, W., "Power Electronics: Converters, Applications and Design", John Wiley & Son, 1995.
4. University of Colorado, Boulder, USA, www.copec.edu
5. Swiss Federal Institute of Technology - ETH Zürich, Switzerland, www.pes.ee.ethz.ch/

EMBEDDED SYSTEMS

A. COURSE OBJECTIVES

Students will:

- learn about system-level design of embedded systems comprised of both hardware and software;
- investigate topics ranging from system modeling to hardware-software implementation;
- explore analysis and optimization processes in support of algorithmic and architectural design decisions;
- gain design experience with case studies using contemporary high-level

methods and tools.

B. COURSE TOPICS

1. An Introduction to Embedded Systems. The Embedded Systems Model. Standards.
2. Embedded Hardware. Embedded Processors. Board Memory. Board I/O. Board Buses
3. Embedded Software. Device Drivers. Embedded Operating Systems. Middleware and Application Software
4. Design and Development. Implementation and Testing.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratories

Program modern microsystems in assembly language and operate its peripheral devices. Interpret how the assembly code generated by a compiler relates to the original C code. Develop various applications (serial communication, web server, data socket) using LabView. Practice thread-based program design with a real-time operating system. Predict, measure and manipulate a program's execution time. Develop systems which integrate sensors&actuators.

D. TEXTBOOKS/REFERENCES

1. T. Noergaard, *Embedded Systems Architecture. A Comprehensive Guide for Engineers and Programmers*, Elsevier Embedded Technology Series, 2005.
2. S.R. Ball, *Embedded Microprocessor Systems: Real World Design* 3rd Ed., Elsevier Embedded Technology Series, 2002.

DIGITAL TELEPHONY

A. COURSE OBJECTIVES

Introduction to speech signal for telephony and its conversion to digital format. Analog and digital companding and multiplexing techniques for telephony signals are analyzed. Techniques and line termination equipments are studied within a digital telephony network framework.

B. COURSE TOPICS

Transmission of the speech signal: parameters, transmission on 2/4 wires, line equipments. **Multiplexing:** techniques, standards, hierarchical multiplexing. **Voice digitization:** sampling, quantization companding laws. **Discrete time multiplexing:** the PCM codec, the PCM frame and the signaling multiframe. **Line interface:** line coding, AMI, HDB-3, 8BZS, 2B1Q, signal regenerators.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Specialized training systems allow the students to practice and apply, in the laboratory, the theoretical knowledge from the course topics. The main topics of the laboratory are: **Sampling and filtering of the speech signal**, **Multiplexing techniques**, **Companding, The PCM frame and channel associated signaling**, **Line coding and transmission equipments**, **Line decoding and the equipments on the receiving side**, **PABX system architecture**, **The subscriber line**.

D. TEXTBOOKS/REFERENCES

1. J. Bellamy, Digital Telephony, Third Edition, John Wiley and Sons, 2000

AUDIO AND VIDEO SYSTEMS

A. COURSE OBJECTIVES

Introduction to multimedia signals: parameters and discretization. Presentation of the main techniques for acquisition, processing, compression, transmission and storage of multimedia signals.

B. COURSE TOPICS

Multimedia signals: text, voice, audio, image, video. Discretization parameters.

Audio and voice signals: parameters, acquisition, processing, compression, storage. Acquisition equipement. Processing techniques and equipment. Compression algorithms and equipment.

Image signals: Parameters. Acquisition and Display Equipment. Processing and Compression.

Video signals. Television systems: analog and digital. Radiofrequency transmission.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Website design (including a short individual project consisting of designing a personal website): Dreamweaver.

Sound processing techniques and equipments: SoundForge.

Image processing.

Spatial filters for feature extraction and image filtering

Histogram based image processing

Complex video signals: PAL, SECAM

D. TEXTBOOKS/REFERENCES

1. K. C. Pohlmann - Principles of Digital Audio, Fifth Edition, McGraw-Hill, 2005, ISBN 0-07-144156-5
2. H. Benoit - Digital television MPEG-1, MPEG-2 and principles of the DVB system, London, John Wiley & Sons,1997

ENGINEERING ETHICS AND COMMUNICATION

A. COURSE OBJECTIVES

1. Provide basic knowledge on the fundamental features of communication in professional environments;
2. Develop and consolidate oral and written communication skills through teaching professional genres relevant to professional structures;
3. Develop team communication skills.

B. COURSE TOPICS

1. The process of communication : components, objectives, context/situation.
2. Communication forms: verbal/non-verbal, oral/written, metacommunication and paralanguage;
3. Oral communication: basic requirements, relevant professional contexts;
4. Public discourse: preparation, techniques, structure, visual aid;
5. The interview: types according to context and content, structure;
6. Application interviews: preparation, participation as interviewee/interviewer;
7. Team communication: efficiency factors, interaction types, advantages and disadvantages;
8. Business letter writing: types, structure, lay-out requirements;

9. Prospecting job market and identifying employer's profiles (agencies, fares, advertisements);
10. Application procedures: letter of application/motivation, application form, curriculum-vitae;
11. Participation in meetings: responsibilities (chairman/ member/ secretary), video-audio conferences;
12. The report: types, structure, lay-out, style;
13. The technical report: research, plan, preparation, editing;
14. Electronic communication: procedures and recommended formulas.

C. APPLICATIONS TOPICS (seminars)

1. Initiating socio-professional contacts;
2. Socializing in various professional contexts;
3. Preparing the job application interview;
4. Letter of application/motivation, curriculum-vitae;
5. International conferences: relevance of cultural differences;
6. Team communication: brainstorming;
7. Electronic messages.

D. TEXTBOOKS/REFERENCES

1. Powel, Mark, *In Company,* Macmillan Press Ltd, Oxford, 2005.
2. Stanton, Nicky, *Mastering CommW1ication,* Macmillan Press Ltd, London, 1996.
3. Strutt, P., *Business English Usage,* Longman, London, 1992

ELECTRONIC EQUIPMENT TESTING

A. COURSE OBJECTIVES

This course is dedicated to the presentation of the most recent testing techniques used in the electronic and telecommunication industry. The course presents digital techniques used for testing electronic components, electronic boards as well as equipment as a whole. It presents the fault models used for simulating digital equipment defects, fault detection and fault simulation techniques. The most important equipment used in the testing process are also presented. The signature analyzer principle is presented, as well as its use in designing fault tolerant systems.

B. COURSE TOPICS

1. Objectives of the testing process
   - Principles
   - Testing levels
2. Electronic components' level testing
   - Parametric testing: static and dynamic parameters
   - Functional testing: microprocessors and microcontrollers, semiconductor memories, A-D and D-A converters, interface circuits
3. Electronic board's level testing
   - Fault models, fault detection, fault simulation
   - Nail bed testing
   - Test stimulus vectors generation
   - One-way activation method
   - Poage method

- Poage-McCluskey method

4. Built-in-self-test methods
   - BILBO method
   - Boundary Scan testing
5. Equipment level testing
   - Digital data communication networks testing: BER determination
   - Video networks testing
   - Multimedia systems testing
6. Equipment for automatic testing
   - Logic analizers
   - Signature analizers
7. Design for testability
8. Fault tolerant equipment design
   - Modular redundancy systems
   - Reservation systems
   - Majority logic decisions
9. Error localisation in telecommunication cables
   - Visual search methods
   - Bridge measuring methods (Murray bridge, Varley bridge, Graf bridge)
   - Impulse based localisation methods

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

4. Radio receivers testing
5. TV receivers testing
6. Video chains testing
7. Video players testing
8. CD and DVD players testing
9. BER testing

D. TEXTBOOKS / REFERENCES

1. Samiha Mourad, Yervant Zorian, *Principles of Testing Electronic Systems*, John Wiley & Sons, New York, 2000
2. Parag K. Lala, *Digital Circuit Testing and Testability*, Academic Press, London, 1997
3. Rex Black, *Managing Testing Process*, Microsoft Press, Redmont, 1999

SOFTWARE DEVELOPMENT

A. COURSE OBJECTIVES

The course is designed to develop in students the knowledge, understanding, skills and values to solve problems through the creation of software solutions.

B. COURSE TOPICS

Legal aspects (use of software covered by a licence agreement), origin of software design ideas, evolution of existing concepts, GUI interface, search engines, visicalc, collaborative development history, the need for software design and development to be inclusive, economic perspectives, social perspectives, ability to work in teams, creativity, design skills, problem-solving skills

C1. APPLICATIONS TOPICS (laboratories, projects)

1. EDK Platform

2. LV parallel processing.
3. Digital filtering
4. Sound analysis
5. PID algorithms
6. Control. CompactRIO applications

C1. APPLICATIONS TOPICS (laboratories, projects)

1. Filter design
2. Digital Echo.
3. Remote lab instrumnetation
4. LXI - SCPI compatible instruments
5. Direct Digital synthesys
6. Coin recognition

D. TEXTBOOKS/REFERENCES

McConnell, S., Code Complete: A Practical Handbook of Software Construction, Mircosoft Press, 2004.

Gamma, E., Helm R., Johnson R., Vlissides, J., Design Patterns: Elements of Reusable Object-Oriented Software, Adison-Wesley, 2005.

MODELING AND SIMULATION

A. COURSE OBJECTIVES

The study of functionality principles for electrical circuits and systems using dedicated programs. To apply test procedures which present the response of electrical systems to different input signals. To implement circuit analysis oriented programs using both graphical and text programming.

B. COURSE TOPICS

Basic modeling and simulation concepts. Continuous-time systems, discrete-time systems, the mathematical model, modelling and simulation approaches, correspondence between electrical and other physical systems MATLAB, LabView and NI Multisim introduction. **State space models**: introduction, state space model calculations, practical examples involving filters, correspondence with the mathematical model. **Using the Laplace transform**: introduction, poles and zeros, transfer functions models, program implementation of transfer functions, conversion between state space models and transfer functions. **Circuit transformations:** Conversion between time and frequency domains, examples and results comparison, eigenvalues, zeros-poles models and stability analysis. **Frequency and time response analysis:** program implementation of power gain, amplitude gain and phase calculations, filter characteristics, general form of Bode plots, step response, impulse response.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratories

Problem solving using MATLAB, LabView and NI Multisim. State space models calculations. Implementation using graphical and text programming. Comparison between graphical and text programming implementation possibilities. State space to transfer function transformations. Rotational antenna dish positioning system example. Transfer Function models. Zero – Pole – Gain models. State – Space models. Conversion between model forms. Conversion between continuous and

discrete models.

Project

Building of filtering circuits and testing them using signal generators and oscilloscopes. Performance analysis and conclusions. The project includes circuit description, functionality, schematics, mathematical calculations and the stability study.

D. TEXTBOOKS/REFERENCES

1. Jim Ledin, Simulation Engineering, CMP Books, R & D Developer Series, 2001, ISBN 1-57820-080-6.
2. Bernard Ziegler, Herbert Praehofer, Tag Gon Kim, Theory of Modelling and Simulation, Academic Press, 2000.
3. www.ni.com, www.mathworks.com.

VHDL

A. COURSE OBJECTIVES

The course content addresses to senior year students in the Electronics and Telecommunications Faculty willing to engage in an advanced study of digital system design using VHDL description language. The aim of the course is to train students on present days design tools technology towards a career in the electronic design industry.

B. COURSE TOPICS

1. Hardware Description languages in design – general introduction
2. Digital circuit modeling using HDL methodology
3. Major constructs and types in VHDL
4. Concurrent assignments in VHDL
5.Sequenssial assignments – process
6.Simulation of VHDL descriptions
7. VHDL descriptions for Synthesis
8. VHDL – Verilog parallel

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

1.Common constructs in VHDL – using ALDEC – Evita
2.Simulation of VHDL descriptions – Active VHDL
3. ISE Xilinx digital design environment
4.Xilinx CoolRunner CPLD family datasheet
5.Using State Diagrams in– VHDL
6.Mixed projects VHDL – Verilor

D. TEXTBOOKS/REFERENCES

1. Peter Ashenden , A VHDL Cook Book, Univ. Adelaide, Australia 1993
2. D Perry VHDL Programming by Examples4th edition McGraw-Hill 2002

DIGITAL SIGNAL PROCESSORS

A. COURSE OBJECTIVES

Digital Signal Processing is the study that deals with the representation of signals as ordered sequences of numbers. DSP also deals with the fact on how to process those ordered sequences.

The course will cover the basics of the generic DSP, DSP software/hardware, a review of the basics of signal processing, system via frequency domain analysis and digital filtering. DSP audio/base band processing, signal (audio) source coding, adaptive DSP algorithms, computationally efficient DSP linear systems, DSP for mobile and wireless, , and DSP on FPGAs will be also treated.
The DSP Laboratory explores some important areas of study and applications of Digital Signal Processing, while simultaneously providing students with the opportunity to experiences DSP and development and implementation work on a first hand basis.

B. COURSE TOPICS

1. The Generic DSP Processor Architecture
2. Application Specific Integrated Circuits
3. DSP Software
4. Signal Processing Review, Frequency Domain Analysis, Digital Filtering
5. DSP Audio/Base band Processing, Signal (Audio) Source Coding
6. Real-Time and Adaptive DSP Algorithms
7. Computationally Efficient DSP Linear Systems DSP on FPGAs

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

the TMS320C67x floating point DSP and TMS320C6000 DSP, realization and performance assessment of algorithms running in real-time

D. TEXTBOOKS/REFERENCES

1. Evangelos Zigouris, DSP systems design, University of Patras ,2007, *www.hep.upatras.gr/class/download/sis_epe_sim_dsp/DSP_System_Design.pdf*
2. David Waldo, Introduction to DSP, Oklahoma Christian University, *www.oc.edu/faculty/david.waldo/projects/nsfccli/DJWtidevcon2002-3.ppt*
3. Mehmet Akhan, Keith Larson, C3x DSP Teaching Kit,University of Hertfordshire/Texas Instruments

MICROELECTRONICS

A. COURSE OBJECTIVES

Basic knowledge on methods and tools to design analog, digital and mixed integrated circuits.

B. COURSE TOPICS

Introduction to CMOS, SOI-CMOS and Bi-CMOS technologies. MOS-FET switching – digital models for MOS-FET.
Body effects, channel length modulation, short channel effects, sub-threshold behaviour, noise – analog models for MOS-FET. CMOS operational amplifiers – typical stages, common mode feedback, autozeroing, stability. Band-gap references, start-up circuitry. Nonlinear circuits – adaptive bias circuitry, comparators, clocked comparators. Mixed signal circuits – component matching for data converters, glitches, clock feedthrough, charge injection. Programmable analog arrays. Analog and digital layout techniques. Clock distribution circuitry. Testing, diagnosis, trimming, tuning, BIST techniques.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

1. CMOS operational amplifier in 0,35 μm CMOS (two parts).
2. Band-gap and sub-bandgap references (two parts).

3. Current-steering digital-to-analog converters in 0,35 μm CMOS (two parts).
4. Successive-approximation analog-to-digital converters in 0,35 μm CMOS (two parts).
5. Layout techniques (four parts).

D. TEXTBOOKS/REFERENCES

1. Harry Veendrick, "Deep Submicron CMOS ICs", second edition, Ten Hagen and Stam, Olanda, 2000 – UPT Library
2. Russel Jacob Baker, "CMOS Circuit Design, Layout and Simulation", Wiley Interscience, 2005 – Teacher's desk.

INTEGRATED DIGITAL NETWORKS

A. COURSE OBJECTIVES

The main objective is the introduction to real-time communication systems using circuit-based switching and multiplexing. Other objectives are defining the standards, methods and circuits used in networks today. The final goal is the understanding of the integration of these networks (voice, video, data) with packet switching and multiplexing.

B. COURSE TOPICS

Digital transmission: stuffing techniques, the Plesiochronous Digital Hierarchy (PDH)**. Integrated Digital Networks:** transmission and switching, voice and data signals, the compression of audio, image and video signals**. The Digital Subscriber Line (DSL):** DSL technologies (ADSL, VDSL, HDSL), parameters and applications**. Integrated Services Digital Networks:** architecture, signaling, services**. The user/network interface:** configurations standards, line coding, S, T and U interfaces**. Broadband ISDN:** ATM**. Synchronous Digital Hierarchy (SDH). Voice and data integrated networks:** Voice over IP, Next Generation Network.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

The laboratory activity is focused on the study of the digital switching center Alcatel 1000E10. The main topics are: The functional architecture of the switching center, The hardware architecture of the switching center, Using the virtual console (instructions and the interrogation of the equipments), The multiprocessor station for PCM terminals, Analog subscriber lines – testing and services, ISDN access, ISDN terminals, ISDN user part of the signaling system CCITT no.7.

D. TEXTBOOKS/REFERENCES

1. J. Bellamy, Digital Telephony, Third Edition, John Wiley and Sons, 2000
2. W. Stallings, ISDN and Broadband ISDN with Frame Relay and ATM, Fourth Edition, Prentice Hall, 1999

VHDL PROJECT

A. COURSE OBJECTIVES

The project accustoms the students with specific problems concerning the design and realization of an electronic circuit using VHDL.

B. COURSE TOPICS

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C. APPLICATIONS TOPICS (laboratories, tutorials, project)
Students will design, simulate, test, and complete a report on an electronic circuit (frequency divider, frequency counter, alarm circuit, simple microprocessors) using VHDL.

D. TEXTBOOKS/REFERENCES

1. I. Jivet – Digital Circuits Design Using HDL Descriptions, Orizonturi Universitare, Timişoara, 2009.

DIGITAL SIGNAL PROCESSORS PROJECT

A. COURSE OBJECTIVES
The project accustoms the students with specific problems concerning the design and realization of digital filter implemented on a digital signal processor.

B. COURSE TOPICS

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C. APPLICATIONS TOPICS (laboratories, tutorials, project)
Students will design, simulate, test, and complete a report on an digital filter (finite impulse response and infinite impulse response) with applications to telecommunications (for instance, for echo cancellation).

D. TEXTBOOKS/REFERENCES

1. Evangelos Zigouris, DSP systems design, University of Patras, 2007, *www.hep.upatras.gr/class/download/sis_epe_sim_dsp/DSP_System_Design.pdf*
2. David Waldo, Introduction to DSP, Oklahoma Christian University, *www.oc.edu/faculty/david.waldo/projects/nsfccli/DJWtidevcon2002-3.ppt*
3. Mehmet Akhan, Keith Larson, C3x DSP Teaching Kit,University of Hertfordshire/Texas Instruments

DIGITAL RADIO COMMUNICATIONS

A. COURSE OBJECTIVES
The course has as main objective to introduce technologies used in digital broadcasting. The main solution for radio transmitters, parameters and architectures are also presented. These technologies use digital modulation to carry the information. The main concerns are related to digital broadcasting and cover principles and standards used in one way communication.

B. COURSE TOPICS
Introduction in broadcasting systems. Analog broadcasting: AM, FM and TV transmitters. FM stereo and RDS systems (principles, signal processing, architectures for transmitters and receivers). Principles of multi carrier transmission. Digital Broadcasting: DAB and DVB (principles, signal processing, DAB and DVB ensemble).

C. APPLICATIONS TOPICS (laboratories)
PLL circuits.
Stereo Coder and Decoder.
Frequency synthesis.
MUSICAM coder
Building and study of FM receiver.

D. TEXTBOOKS/REFERENCES

1. Dietmar Kopitz, Bev Marks - *RDS: The Radio Data System*, Artech House, Boston • London, 1999 EBU
2. W. Hoeg, T. Lauterbach – *Digital Audio Broadcasting – Principles and Applications of Digital Radio*, John Wiley 2003

OPTICAL COMMUNICATIONS

A. COURSE OBJECTIVES

This course will provide a practical introduction to the basic principles of optical fiber systems and networks. The course will emphasize the physical properties and operation of components that comprise optical systems (fiber, semiconductor lasers, photodetectors, etc.).The basic elements of optical network operation will also be described. The material will cover a broad number of topics to allow the student to understand the underlying principles of the field and to be prepared for more detailed study in the form of advanced courses and/or research.

B. COURSE TOPICS

The course material is divided into eleven modules as follow: **Overview of optical communication systems**; **Review of optics**(interference, diffraction, coherence and polarization); **Characteristics of optical fibers**(propagation in multimode and single-mode fibers, coupling into and out of fibers, attenuation, group-velocity dispersion, optical nonlinearities, polarization-mode dispersion, fiber manufacturing, air-core fibers, and test equipment); **Optical waveguides**. Review of digital communications (a summary of important concepts of digital communications, including baseband and broadband digital transmission); **Optical sources and transmitters** (a review of the physics of light emission and amplification in semiconductors, light-emitting diodes, semiconductor lasers and optical transmitters); **Optical detectors and receivers**(covers the physics and technology of the detection and demodulation of light, including photoconductors, photodiodes, phototransistors, and receiver systems); **Optical amplifiers** (semiconductor laser amplifiers, EDFA, praseodymium-doped fiber amplifiers, planar amplifiers, Raman amplifiers and optical repeaters); **Noise and detection** (covers noise arising from the properties of fibers, transmitters, receivers and amplifiers, as well as the determination of the bit error rate in terms of system parameters); **Dispersion in optical communication systems**(covers dispersion in multimode fibers, dispersion in single-mode fibers, dispersion-induced pulse broadening in single-mode fibers and system implications); **Optical link design**(an overview of the design process for a point-to-point optical link).

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

The practical activity is based on the following laboratory exercises: 1.Total internal reflection; 0. Fiber welding and measurement; 3.Short distance transmission; 4.OTDR measurement; 5. Study of 155 Mbit/s point to point transmission; 6.Study of 1,2 Gbit/s media convertors. 7. Matlab simulation of optical communication modules.

D. TEXTBOOKS/REFERENCES

1. Comunicatii Optice, byAdrian Mihaescu ,Editura de Vest Timisoara,2004,ISBN 973-36-0394-5, (english translation for students use, available in digital form).
2. Fiber Optic Communications (Third Edition),by Gerd Keiser, McGraw-

Hill(www.mhhe.com/engcs/electrical/keiser/).

3. Fiber-Optic Communication Systems, 3rd Edition, by Govind P. Agrawal (Wiley)(ISBN: 0-471-21571-6).

IMAGE PROCESSING

A. COURSE OBJECTIVES

This course provides understanding of basic techniques used in image processing. Students will learn the main theoretical concepts motivating currently used image processing techniques and gain the ability to use them in practical applications. A special attention will be paid to C++ programming of digital image processing algorithms.

B. COURSE TOPICS

Introduction. Definitions, Applications, Visual Perception, Colours, Sampling and Quantization, Mathematical representation of digital images. **Multidimensional linear operators.** Discrete convolution, Transforms. **Basic image processing techniques.** Grey level and colour processing, Geometric transforms, Linear filtering. **Nonlinear filters**. Median filters, L filters,Morphological filters, Binomial filters, Mean shift filter, Detail enhancement filters. **Image segmentation.** Edge detection, Clustering, Region growing. **Feature extraction and pattern recognition**. Useful image descriptors, Bayes rule, Parametric estimation, nonparametric estimation.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Contrast enhancement. Geometric transforms. Linear image smoothing. Median filter. Edge detection. Image segmentation. Pattern classification.

D. TEXTBOOKS/REFERENCES

1. W.K Pratt, *Digital Image Processing;* Wiley, ISBN 0471374075, 2001
2. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, 3rd. Edition, Prentice Hall, 2008
3. Bovik, Ed., *Handbook of Image and Video Processing,* Academic Press 2000.

BIOMEDICAL ELECTRONICS

A. COURSE OBJECTIVES

The breadth of activity of biomedical engineers is significant. The field of biomedical electronics include a wide-range of activities : application of engineering system analysis, detection, measuremen, and monitoring of physiologic signals, diagnostic interpretation via signal-processing techniques of bioelectric data, therapeutic and rehabilitation procedures and devices, devices for replacement or augmentation of bodily functions, computer analysis of patient-related data and clinical decision making, medical imaging and the creation of new biologic products..

B. COURSE TOPICS

Physiologic systems: An outline of cardiovascular structure and function; Endocrine system; Nervous system; Vision system; Auditory system; Gastrointestinal system; Respiratory system; **Bioelectric phenomena:**Basic Electrophysiology; Volume Conductor Theory; The electrical properties of tissues; Membrane models; Numerical methods for bioelectric field problems; Principles of

Electrocardiography; Principles of Electromyography; Principles of Electroencephalography; Biomagnetism; Electric stimulation of excitable tissue; **Biomedical sensors:** Physical measurements;Biopotential electrodes; Electrochemical sensors; Optical sensors; Bioanalytic sensors; **Biomedical signal analysis:**Biomedical signals:origin and dynamic characteristics, frequency-domain analysis;Digital biomedical signal acquisition and processing; Compression of digital biomedical signals; Time-frequency signal representations for biomedical signals; Higher order spectra in biomedical signal processing; Neural Networks in biomedical signal processing; Complexity, scaling and fractals in biomedical signals; Biomedical signal processing and networked multimedia communications; **Medical instruments and devices:** Biopotential amplifiers; Noninvasive assessment of arterial blood pressure and mechanics; Cardiac output measurement; Bioelectric impedance measurements; Implantable cardiac pacemakers; Implantable stimulators for neuromuscular control; External defibrillators; Implantable defibrillators; Electrosurgical Devices; Mechanical ventilation; Biomedical lasers, noninvasive optical monitoring.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

BioBench BasicsI. BioBench BasicsII. Levenberg-Marquardt parameter estimation algorithm. Analysis of blood flow and pressure curves based on an average heart cycle. Cardiopulmonary systems interactive model. Cardiovascular hemodynamics closed loop model. Pulmonary system dynamic mode.l

D. TEXTBOOKS/REFERENCES

1. Tărâţă, Mihai, *Medical Electronics*, Sitech Publishing House, Craiova, 1999.
2. Rangayyan, Rangaraj, *Biomedical Signal Analysis,*Wiley, New York, 2002.
3. Aldroubi, Akram and Unser, Michael, *Wavelets in Medicine and Biology,* CRC Press, 1996.

ELECTRONIC PACKAGING

A. COURSE OBJECTIVES

This course presents the technologies that allow the conversion of an electronic design into a physical object, and the parasitic electromagnetic and thermal effects that accompany this process.

B. COURSE TOPICS

Chip level packaging; Printed circuit board technologies; Assembly technologies; Computer aided design and manufacturing; Electrostatic protection; Signal and power integrity; Thermal management of electronics.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Laboratory: PCB Fabrication and assembly; CAM processing; Crosstalk and reflections on PCBs; Power supply filtering and decoupling; Thermal regime of electronic equipments.

Project: Technological design of an electronic equipment (components selection, libraries, schematic design, mechanical and technological analysis, electromagnetic design, thermal design, PCB design)

D. TEXTBOOKS/REFERENCES

1. G.R. Blackwell: Electronic Packaging Handbook, CRC Press, 2000
2. R. Remsburg: Thermal Design of Electronic Equipment, CRC Press, 2001

3. S.Thierauf: High Speed Circuit Board Signal Integriy, Artech House, 2004

WIRELESS COMMUNICATIONS

A. COURSE OBJECTIVES

The lectures contain the basic principles of Mobile radio. Different types of Mobile networks are presented, and also the standards covering various solutions.

B. COURSE TOPICS

1. General considerations about mobile communications, introduction to multiple access protocols.
2. Cellular Networks.
3. The GSM System.
4. The UMTS system.
5. 3G evolution and LTE.
6. Wireless Networks.
7. Wireless PAN and Bluetooth.
8. Wireless LAN and WiFi.
9. Wireless MAN and WiMAX.

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

The main laboratory works cover: BaseTransceiverStation (BTS), Base Station Controller (BSC), Operations &Maintenance Centre (OMC-R), Transmission System (TSS).

Laboratory works are held in GSM lab which contains equipment from Alcatel.

D. TEXTBOOKS/REFERENCES

1. Mobile Radio Networks, B.H. Walke, John Wiley & Sons, 2000, (electronic form).
2. Fundamentals of Wireless Communication, D. Tse, P. Viswanath, Cambridge University Press 2005, (electronic form).
3. Wi-Fi, Bluetooth, Zig Bee And WiMAX, H. Labiod, H. Afifi, C. De Santis, Springer 2007, (electronic form).
4. Mobile Communications (in Romanian), E. Marza, C.Simu, Editura de Vest, Timisoara 2003, (20 copies in library).

SOFTWARE PROJECT

A. COURSE OBJECTIVES

The project accustoms the students with specific problems concerning a software project. This will provide the skills and abilities to handle complex systems, where the electronic engineer is confronted with aspects of both hardware and software.

B. COURSE TOPICS

-

C. APPLICATIONS TOPICS (laboratories, tutorials, project)

Students will design, test and complete a report on a computer program for a specific electronic circuit, based on a microcontroller out of a broad range of commercially available microcontrollers.

D. TEXTBOOKS/REFERENCES

Gontean – Digital Integrated Circuits*,* Politehnica Publishing House, Timişoara, 2007.

"POLITEHNICA" UNIVERSITY OF
TIMIŞOARA
FACULTATY OF ELECTRONICS AND
TELECOMMUNICATIONS

CURRICULA AND SYLLABI

Major: ELECTRONICS AND TELECOMMUNICATIONS

MASTER STUDIES

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COMMUNICATION NETWORKS

CURRICULUM
Major: Electronics and Telecommunications – Master Studies in English

Nr crt	Disciplina	C	S	L	P	Cr/Ex*
Ist Year, 1st Semester						
IInd Year, 3rd Semester						
1	Mobile Communication networks	2	0	2	0	8/E
2	Optical Communication Systems and Networks	2	0	2	0	8/E
3	Elective 3	2	0	1	0	7/E
4	Elective 4	2	0	0	1	7/D
	Total	**8**	**0**	**5**	**1**	**30**
IInd Year, 4th Semester						
1	Practical Training/Research					15/D
2	Master Thesis Elaboration					15/E
	Total					**30**

Elective 1	Modern Programming Techniques PCBA Design and Manufacturing Mathematical Morphology
Elective 2	Network Planning Computer Networks Administration
Elective 3	Resource Management in Wireless Networks Broadband Communication Networks
Elective 4	Advanced Multimedia Technologies Spectral Analysis and Estimation

Legend

C	S	L	P	Cr/Ex*
Course	Seminar	Laboratory	Project	Credits/Examination form

* Evaluation form: E = exam; D = distributed evaluation

ANTENNAS AND WAVE PROPAGATION

A. COURSE OBJECTIVES

Applications oriented approach to antennas and wave propagation motivarted by recent developments in fields such as wireless communications, information technology, radar and material science.

B. COURSE TOPICS

Maxwell's equations: Maxwell's equations; Contitutive Relations; Boundary conditions; Energy flux and conservation; Harmonic time dependence; Model for conductors, dielectrics and plasma. **Plane waves:** Plane waves in lossless and lossy media; Wave impedance; Polarization; Energy density and flux; Oblique incidence. **Radiation fields:** Fields of electric and magnetic dipoles; Radiation fields; Fields of linear, wire antennas. **Antenna parameters:** Directivity, gain, bandwidth; Effective area and effective length; Antenna and system noise. **Wire antennas:** Linear and dipole antennas; Vee, rhombic and loop antennas; Yagi (coupled) antennas. **Aperture antennas:** Horn antennas; Microstrip antennas; Parabolic reflector antennas; Lens antennas; **Antenna arrays:** Array pattern multiplication; Visible region; Grating lobes; Uniform arrays; Directivity, steering and beamwidth; Design.

C. APPLICATIONS TOPICS

The project will consist of one of the following topics

1. Design of a wire antennas
2. Radiation patterns for dipole and wire antennas (Matlab programming)
3. Radiation patterns for antenna arrays (Matlab programming)
4. Adaptive algoritm for antenna array beamsteering (Matlab programming)
5. Field simulation of a microstrip antenna (with a commercial EM solver)

D. REFERENCES

1. C. A. Balanis, *Antenna Theory: Analysis and Design*, New York: Wiley, 2005.
2. R. E. Collin, *Antennas and Radiowave Propagation*, New York: McGraw-Hill, 1985
3. S.J. Orfanidis, *Electromagnetic Waves and Antennas*, http://www.ece.rutgers.edu/~orfanidi/ewa/

ADVANCED TOPICS IN SIGNAL PROCESSING

A. COURSE OBJECTIVES

This course is intended to give some knowledge and competences in using wavelets in signal processing. Another major goal of this course is to introduce the problem of statistical signal processing which means estimation and detection. These topics are present in almost all M.Sc. curricula, worldwide. The importance of using wavelets and statistical signal processing in communication engineering and other related fields is obvious. This course offers an essential support for other courses dealing with transmission over fading channels and also for the general theory of digital modulation.

B. COURSE TOPICS

1. Wavelets. The concept of multiresolution. Digital wavelet transform. Presentation and use of Wavelet toolbox and WaveLAB for 1D and 2D signals.

2. Cramer-Rao Lower Bound. Minimum Variance unbiased estimation; Cramer-Rao theorem. Some examples.

3. Maximum Likelihood Estimation. The likelihood function. The concept of estimation with maximum likelihood. Algorithms for ML estimation. Some examples.
4. Least Squares Estimation. The estimation problem in the case of lack of any statistical properties. Computer minimization techniques of the cost function. Basics on Kalman filtering. Some examples.
5. Neyman-Pearson Detection Strategy. The constant false alarm criterion. Detection threshold. Probability of correct detection. Some applications in image processing, database searching, RADAR/SONAR.
6. Bayesian Detection Strategy. The risk function. Detection using the minimum risk rule. ML Bayesian detection and MAP Bayesian detection. Examples of using the Bayesian strategy in communications. ML and MAP receivers.

C. APPLICATIONS TOPICS

Project can be on one of the following topics:

- Denoising using wavelets,
- Watermarking using wavelets,
- Inpainting using wavelets,
- Parameter estimation using Cramer-Rao techniques,
- Parameter estimation using ML techniques,
- Parameter estimation using LS techniques,
- Detection using Neyman-Pearson strategy in watermarking,
- Bayesian detection for communications.

The student will pick a journal paper or 2-3 conference papers from the course webpage (it is assumed that the student will also read back references to understand that paper).
Goals for the project are

* Reading the papers in full detail and needed back references,
* For the paper, the student will choose one part of the paper and simulate the proposed algorithm to re-generate the results given or try it on a related application,
* Make a short presentation explaining the ideas of the papers and what they obtain from the simulations and why
* Prepare a report explaining the above in more careful detail

Requested: WaveLAB or Wavelet toolbox for wavelets assignments. Simulations will be done in MATLAB or LabVIEW.

D. REFERENCES

1. Corina Nafornita, *Digital Watermarking in the Wavelet Domain*, Politehnica Publishing House, Timisoara, 2005, ISBN 973-625-236-1.
2. Corina Nafornita, *Signals and Systems, vol. 1*, Politehnica Publishing House, 2009, ISBN 978-606-554-013-2 (978-606-554-014-9 vol I).
3. Steven M. Kay, *Fundamentals of statistical signal processing,* Prentice Hall, 1993 (vol I) and 1998 (vol II).
4. Petre Stoica, Randolph Moses, *Spectral analysis of signals*, Prentice Hall, 2005.
5. Poor, H. V., *Introduction to Signal Detection and Estimation*, Springer; 2nd edition March 16, 1998), ISBN-10: 0387941738, ISBN-13: 978-0387941738.

SELECTED TOPICS IN COMMUNICATIONS ENGINEERING

A. COURSE OBJECTIVES

This course presents an overview of modern communications technologies and challenges. The main objective is to provide knowledge for understanding the technological developments, that are at the heart of the proliferation and fusion of networks taking place today Another objective is providing skills in identifying problems and the appropriate method to be applied, especially in switching, routing and congestion control. It prepares students to understand the issues facing the designers of next-generation data networks and to undertake applied projects or research in the areas of communications network design.

B. COURSE TOPICS

1. High speed 4G communications. Characteristics of modern communications networks. Architectures. Technologies. Challenges. Long term evolution communications.

2. Delay models in data networks Multiplexing on a Communication Link. Queuing models. Queuing systems. Self-similarity traffic- and forecasting. Long range dependency communications.

3. **Multiaccess communication** Introduction on multi-access problem in satellite , radio, data an telephone communications. Splitting Algorithms.

4. Routing. Main Issues in Routing, An Overview of Routing in Practice. .Network Algorithms and Shortest Path Routing. Adaptive Routing Based on Shortest Paths Flow Models, Optimal Routing, and Topological Design. Optimisation of routing using intelligent techniques

5. Congestion control. Objectives. Window Flow Control. Flow Control Schemes Based on Input Rate Adjustment. Congestion control by using neural networks.

C. APPLICATIONS TOPICS

1.Packet Queuing and Scheduling
2. Ad hoc wireless network traffic-self-similarity and forecasting
2.Multiacces communications
3.Routing Algorithms
4.Intelligent routing
5.Congestion control using intelligent techniques
6.Border Gateway protocol routing
7.Long term evolution communications

D. REFERENCES

1. Dimitri Bertsekas, Robert Gallagher, *Data communications networks, 2nd edition*, Prentice Hall International, Inc. Englewood Cliffs, New Jersey, 1991
2. *William Stallings, Data and Computer Communications* (8th Edition), Prentice Hall, Inc, 2009
3. A. Leon-Garcia, I. Widjaja. *Communication Networks (2nd edition)*. McGraw-Hill, 2004
4. Deep Medhi, Karthik Ramasamy , *Network routing. Algorithms, Protocols, and Architectures*. Morgan Kaufmann Publishers, 2007

MODERN PROGRAMMING TECHNIQUES

A. COURSE OBJECTIVES

The course provides a broad, solid understanding of essential Visual Basic topics. It describes the Visual Basic language itself and explains how to use it to perform a host of important development tasks. It also explains the forms, controls, and other objects that Visual Basic provides for building applications in a modern windowing environment. It does cover the majority of the technologies that developers need to build sophisticated applications.

B. COURSE TOPICS

1. Introducing .NET. The .NET Framework The Visual Basic Language. Types, Objects, and Namespaces.
2. Developing ASP.NET Applications. Visual Studio. Web Form Fundamentals. Web State Management. Error Handling, Logging, and Tracing. Deploying ASP.NET Applications
3. Data Types, Variables, and Constants. Operators
4. Subroutines and Functions. Inheritance Mode. Property Procedures. Extension Methods. Lambda Functions. Relaxed Delegates. Partial Methods
5. Program Control Statements. Decision Statements. Single Line If Then. Multiline If Then. Select Case. Enumerated Values. IIf. If. Choose. Looping Statements. For Next. Non-integer For Next Loops. For Each. Exit and Continue
6. Building Better Web Forms. Validation Rich Controls. User Controls and Graphics. Styles, Themes, and Master Pages. Website Navigation
7. Working with Data. ADO.NET Fundamentals. Data Binding. The Data Controls. Files and Streams.XML

C. APPLICATIONS TOPICS

1. Introduction to the IDE. Menus, Toolbars and Windows.
2. Visual Basic Code Editor. Debugging.
3. Selecting Windows Forms Controls. Using Windows Forms Controls. Windows Forms
4. Selecting WPF Controls . Using WPF Controls .WPF Windows
5. Database Controls and Objects
6. OOP Concepts. Classes and Structures. Namespaces. Collection Classes. Generics.
7. Graphics. Drawing Basics. Brushes, Pens, and Paths. Text. Image Processing. Printing. Reporting.
8. Interacting with the Environment. Configuration and Resources. Streams. File-System Objects. Windows Communication Foundation. Useful Namespaces.

D. REFERENCES

1. MacDonald Matthew, Beginning ASP.NET 3.5 in VB 2008, Apress, Springer Verlag, 2007.
2. Stephens Rod, Visual Basic® 2008. Programmer's Reference, Wiley Publishing, 2008.

PCBA DESIGN AND MANUFACTURING

A. COURSE OBJECTIVES

- To provide advanced knowledge and skills about all relevant aspects

regarding the design, development and manufacturing of complex printed circuit board assemblies

- To provide basic knowledge about signal integrity and thermal management of electronic modules
- To introduce modeling and simulation techniques for virtual prototyping of printed circuit board assemblies

B. COURSE TOPICS

- An overview of electronic technologies
- Advanced packaging of electronic devices
- Printed circuit board manufacturing technologies
- Module assembly technologies
- Computer aided manufacturing
- Intelligent design of PCBA (aka: Design for Excellence)
- Signal integrity issues in PCB design
- Virtual prototyping for signal integrity
- Thermal management of electronic modules
- Virtual prototyping for thermal management

C. APPLICATIONS TOPICS

- Printed circuit board manufacturing technologies
- Computer aided manufacturing of PCBA
- Expert systems for intelligent design
- Electrical modeling of printed circuit boards
- Signal integrity analysis of printed circuit boards
- Power integrity analysis of printed circuit boards
- Thermal analysis of electronic modules

D. REFERENCES

1. Clyde F. COOMBS (ed.) Printed Circuits Handbook, McGraw Hill, 2001.
2. Glenn BLACKWELL (ed.), The Electronick Packaging Handbook CRC Press, 2000.
3. Joseph FJELSTAD, Flexible Circuit Technology, BR Publishing, 2006.
4. Happy HALDEN, The HDI Handbook, BR Publishing, 2009.
5. Rudolf STRAUSS, SMT Soldering Handbook, Newnes, 2008.
6. Ralph REMSBURG, Thermal Design of Electronic Equipment, CRC Press, 2001.
7. Stephen THIERAUF, High Speed Circuit Board Signal Integrity, Artech House, 2006.
8. Brian YOUNG, Digital Signal Integrity: Modeling and Simulation with Interconnects and Packages, Prentice Hall, 2001.

MATHEMATICAL MORPHOLOGY

A. COURSE OBJECTIVES

The course provides advanced theoretical foundations of mathematical morphology, a powerful framework for the analysis and processing of geometrical structures. Its main applications are signal processing, particularly image processing. Students following this course will acquire the ability to derive properties of morphological

operators, as well as the modelling skills needed in finding morphology based solutions to engineering problems.

B. COURSE TOPICS

Basic structures and operations
Properties of morphological operations
Derived morphological operators
Morphological filters
Morphological segmentation
Shape analysis using mathematical morphology

C. APPLICATIONS TOPICS

Dilation and erosion
Opening and closing transforms
Grey scale morphological filtering
Skeletons and thinning
Morphological gradients
Watershed segmentation
Shape analysis using mathematical morphology

D. REFERENCES

1. *Morphological Image Analysis; Principles and Applications* by Pierre Soille, ISBN 3540-65671-5 (1999), 2nd edition (2003)
2. *An Introduction to Morphological Image Processing* by Edward R. Dougherty, ISBN 0-8194-0845-X (1992)
3. Jean. Sera, "Mathematical Morphology Online Courses", http://cmm.ensmp.fr/~serra/cours/index.htm

PATTERN RECOGNITION

A. COURSE OBJECTIVES

The course addresses the main concepts in pattern recognition techniques from both theoretical and practical point of view. Our goal is to provide the knowledge needed to understand research papers and to solve practical pattern recognition applications.

B. COURSE TOPICS

Introduction
Bayesian Decision Theory
Maximum Likelihood and Bayesian Parameter Estimation
Nonparametric Techniques
Linear Discriminant Functions and Neural Networks
Feature Selection and Extraction
Machine Learning
Unsupervised Learning and Clustering

C. APPLICATIONS TOPICS

Image feature extraction
Normal BayesClassifier
K-Neares neighbour classifiers
Support Vector Machine Classifiers
Decision Trees
Boosting

Espectation Maximization
Neural Networks

D. REFERENCES

1. R.O.Duda, P.E.Hart, D.G. Stork, "Pattern Classification, 2nd Edition , Wiley 2000
2. C.M. Bishop, "Neural Networks for Pattern recognition", Oxford University Press, 2004.

NETWORKS MODELING

A. COURSE OBJECTIVES

The course has as main objectives the theoretical and practical aspects regarding telecommunications networks simulation in order to evaluate and optimize their performances. The students will gain insights in statistics and stocastic processes as well as modelling and simulation of discrete event systems. Techniques for analysing systems performances are also considered. The purpose of this lecture is to introduce simulation techniques as a necessary instrument for studying stochastic systems with discrete events.

B. COURSE TOPICS

Stochastic processes used in modelling: Basis concepts; Properties; Markov model;

Queueing systems simulation: Introduction to queueing systems theory; Service processes; Poisson processes; Exponential negative law;

Traffic clasification: Traffic in circuits switched systems;Traffic in packet switched systems: Data traffic at packet level; Data traffic at flow level(TCP and UDP);

Models:Poisson model- Application to flow level modelling of streaming data traffic, Erlang model- Application to telephone traffic modeling in trunk network, Binomial model, Engset model-Application to telephone traffic modelling in acces network; Queueing model – Application to packet level modelling of data traffic;Sharing systems-Application to flow level modelling of elastic data trafic;

Queueing networks: Burke's theoreme; Exponential servers chain; The G/D/1 chain;

Telecommunications networks modelling: Stochastic networks; Open networks, Jackson networks

Simulation of systems with multiple series servers; Applications in telecommunications networks performance evaluation and design;

C. APPLICATIONS TOPICS

Laboratory no. 1. Arrival processes models;
Laboratory no.2. Performance evaluation in different traffic models: Erlang model, Engset model, Binomial model Sharing model;
Laboratory no.3. Taylor software presentation;
Laboratory no.4. Simulation and performance evaluation of the M/M/1/N system
Laboratory no.5. Continuous processes modeling;
Laboratory no.6. Performance parameters evaluation;

D. REFERENCES

1. Recent Advances in Modeling and Simulation Tools for Communication Networks and Services, Nejat Ince (Author, Editor), Arnold Bragg (Editor)

2. J. F. Hayes, Thimma V. J., Gannesh Babu, *Modeling and analysis of Telecommunications networks*, Wiley, 2004
3. G. Fiche, G. Hebuterne, *Trafic et performances des reseaux de telecoms*; GET et Lavoisier, Paris, 2003.
4. 3.G. Niculescu, *Analiza şi modelarea sistemelor de comunicaţii*; Editura Matrix Rom; Bucureşti 1997.
5. H. Akimaru, K. Kawashima, *Teletrafic. Theory and Applications*; Springer-Verlag; Berlin Heidelberg, New York, 1993.

VIDEO NETWORKS

A. COURSE OBJECTIVES

Introduction to video signal and digitization parameters. Presenting the compression and transmission techniques. Presenting the MPEG4, H.264, MPEG7 and MPEG21 standards.

B. COURSE TOPICS

Baseband signals: Voice, Image, Video, Data; **Compression techniques:** Lossless compression, Lossy compression; **Video Compression:** Video formats, Quality assessment (Subjective methods, Objective methods), Video coding concepts (Video CODEC, Temporal model, Image model, Entropy coding, The hybrid DPCM/DCT video codec model, Video coding standards) ; **The MPEG4 Visual standard:** Basic concepts (tools, objects, profiles and levels), Coding rectangular frames, Coding arbitrary shaped regions, Scalable video coding and scalable profiles, Texture coding, Studio quality video profiles, Coding synthetic visual scenes; **The H.264 standard:** Basic concepts, H.264 structure, H.264 profiles; **The MPEG7 and MPEG21 standards:** Characteristics, Structure.

C. APPLICATIONS TOPICS

Manipulating image data using Visual C++ and OpenCV; Accessing square blocks within an image; The forward Discrete Cosine Transform; The inverse DCT; Quantization; Coefficients reordering and RLE; RLE decoding and restoring coefficients order; Entropy coding; Entropy decoding; The Discrete Wavelet Transform.

D. REFERENCES

1. Iain E. G. Richardson, *H.264 and MPEG-4 Video Compression – Video Coding for Next-generation Multimedia;* John Wiley & Sons; England, 2003
2. M. Oteşteanu*, Sisteme de transmisie şi comutaţie;* Editura Orizonturi Universitare; Timişoara, 2001

NETWORK PLANNING

A. COURSE OBJECTIVES

The lectures contain the basic principles of Radio network planning. Radio links engineering and radio coverage topics are presented. Applications for different types of Mobile networks are also explained and developed.

B. COURSE TOPICS

1. Intro Radio Network Planning and Optimisation
2. Radio site engineering
3. Microwave link engineering

4. Mobile Radio Channel and Fading
5. Radio Link Engineering in Mobile Networks
6. Link budgets for GSM, UMTS and LTE
7. Radio coverage aspects
8. Outdoor and indoor propagation models
9. Geospatial data for Network planning

C. APPLICATIONS TOPICS

The main laboratory works cover: Microwave links design, Link budget calculations for different radio technologies, Propagation models principles and software implementation, Coverage planning.

Laboratory works are held in GSM lab which contains equipment from Alcatel

D. REFERENCES

1. **Mobile Radio Networks**, B.H. Walke, John Wiley & Sons, 2000, (electronic form).
2. **Fundamentals of Wireless Communication**, D. Tse, P. Viswanath, Cambridge University Press 2005, (electronic form).
3. **Advanced Cellular Network Planning and Optimisation** Edited by Ajay R Mishra**,** John Wiley & Sons Ltd, 2007.
4. Mobile Communications **(in romanian), E. Marza, C.Simu, Editura de Vest, Timisoara 2003, (20 copies in library).**

COMPUTER NETWORKS ADMINISTRATION

A. COURSE OBJECTIVES

The main goal of this discipline is to endow students with theoretical and practical knowledge regarding computer networks administration and management. The main objectives of the course classes are to prepare students to understand and practice network administration, network requirements estimation and allocation, network setup, network security, and network management.

B. COURSE TOPICS

1. **Introduction in network administration**: computer networks fundamentals, TCP/IP networks, network administration (2h)
2. **Design, install and configure computer networks**: network design, planning, equipments' setup, OS configuration, documentation (2h)
3. **Routing**: Routing protocols, Routing rules, balancing network utilization (2h)
4. **Network applications and services**: DNS, DHCP, WINS, SMTP, POP/IMAP, HTTP, FTP (3h)
5. **Directory services**: LDAP, ActiveDirectory, Authentication and authorization (3h)
6. **Security policies**: security planning, security monitoring, access control (2h)
7. **Network security**: firewall, VPN, IPSec, anti-virus, anti-spam (2h)
8. **Network management**: SNMP, CMIP, MIB, SNMP (4h)
9. **Wireless networks administration**: standards, design rules, equipments, security (2h)
10. **Quality of services**: QoS, ToS, MPLS, SLA. (2h)
11. **Network troubleshooting**: network tools, test cases, service validation (2h)

12. **Intranet and Internet services configuration and administration**: IIS, Apache, applicaton services. (2h)

C. APPLICATIONS TOPICS

1. Network planning, installing and setup
2. Monitoring network protocols: Whireshark
3. Network management - D-View
4. SNMP & MIB
5. VPN setup
6. AD setup
7. Firewall setup
8. IIS/Apache setup
9. Email server setup
10. Routing protocols
11. Security policies
12. WLAN setup

D. REFERENCES

1. Craig Hunt, TCP/IP Network Administration, 3rd Edition, O'Reilly, 2002.
2. Roberta Bragg, Craig Hunt, Windows Server 2003 Network Administration, O'Reilly, 2005.
3. Mark Burgess, Principles of Network and System Administration, John Wiley and Sons, 2004.

MOBILE COMMUNICATION NETWORKS

A. COURSE OBJECTIVES

The course provides technical information about the most important aspects of 3GPP LTE according to release 8 specification, from basic concepts to advanced topics and future directions.

B. COURSE TOPICS

The context for the Long Term Evolution of UMTS.

System architecture based on 3GPP SAE. Network architecture and protocols. LTE Radio Protocols. Control plane protocols. User plane protocols.

OFDM, OFDMA and wider-band single-carrier transmission. Channel Coding and Link Adaptation.

Physical Layer for downlink and uplink. Physical data and control channels.

Scheduling, link adaptation and hybrid ARQ. Multi-user scheduling and interference coordination.

Radio resource management.

Multi-antenna techniques: MIMO in LTE.

User mobility.

Power control.

Voice service in LTE. Voice over IP (VoIP)

LTE-Advanced. Performance of 3G evolution

C. APPLICATIONS TOPICS

The students should elaborate a semester project on an individual theme according to the course topics.

D. REFERENCES

1. H. Holma, A. Toskala (editors), **LTE for UMTS – OFDMA and SC-FDMA Based Radio Access**, John Wiley & Sons, 2009
2. F. Khan, **LTE for 4G Mobile Broadband. Air Interface Technologies and Performance**, Cambridge University Press 2009
3. E. Dahlman, S. Parkvall, J. Sköld and P. Beming, **3G Evolution HSPA and LTE for Mobile Broadband**, Second edition, Elsevier, 2008.

OPTICAL COMMUNICATION SYSTEMS AND NETWORKS

A. COURSE OBJECTIVES

The main objective of this course is to give the student the ability to analyse and design optical systems and networks. The course will emphasize the physical properties and operation of components that comprise optical systems (fiber, semiconductor lasers, photodetectors, etc.) and optical networks (optical couplers, optical amplifiers, WDM components etc.). The basic elements of optical network operation will also be described, taking into account the constraints of the physical layer, the type of traffic to be transported and the upper level protocols. To get this objective the course starts by covering first generation optical systems and networks, where the optical technology is limited by transmission (FDDI, SONET). The second generation networks (SONET next generation, WDM) are then covered in detail, starting with the study of optical network elements needed for the implementation of all-optical network nodes.

B. COURSE TOPICS

Outline syllabus:

Cap.1 Introduction.

Cap.2 Fiber optical lines, physical level : Basics of numerical communication in optical channel (models, attenuation , dispertion, noise,etc.); Fibers and optical devices (optical fibers, emitters, receeivers,couplers etc.); Line WDM systems (components and design).

Cap.3 Optical networks: Optical network topology: Optical network devices (star couplers, optical switches,etc.).

Cap4. Optical network design:Client models; Routing and traffic models; Optimization algorithms and methods

(Routing algorithms, Integral software control, Heuristical algorithms and optimization).

Cap.5 Software control for optical networks: Software control of large transport networks; MPLambdaS /GMPLS; rapidly reconfigurable optical networks.

Cap.6 Optical networks: FDDI; SONET/SDH and SONET next generation; WDM metropolitan optical networks.

C. APPLICATIONS TOPICS

Laboratory: Network fiber optical devices; FDDI; SONET/SDH; Measuring methods for fiber optical systems and networks.

Project: MatLab models for optical fiber systems and networks devices.

D. REFERENCES

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks Second Ed., 2002, Morgan Kaufmann Publishers

2. Jun Zheng,H.T.Mouftah,Optical WDM Networks,2004,IEEE Press.
3. Adrian Mihaescu ,Comunicaţii Optice,2005,Editura de Vest,Timişoara.

RESOURCE MANAGEMENT IN WIRELESS NETWORKS

A. COURSE OBJECTIVES

The main objective of the course is to present the concept of Radio Resources Management in wireless networks, consisting in a set of strategies and algorithms for controlling some important parameters, in order to utilize the limited radio spectrum resources and radio network infrastructure as efficiently as possible and to improve Quality of Service and general system performance in wireless networks.

B. COURSE TOPICS

Radio resources management (RRM) in wireless networks. Radio Resource concept. Radio planning, network planning, adaptive system management.

Resources management in 2G systems. RRM in GSM-GPRS/EDGE wireless networks.

Resources management in 3G systems. RRM in WCDMA. RRM functions. Admission control, Congestion control, Code management, Handover, Power control, MAC and packet scheduling, Interactions among RRM functions. System characteristics relevant at RRM level. RRM Algorithms.

Radio Resource Management in WiMAX. Frequency band allocation. Link budget. Call Admission Control1. Handover in WiMAX. Modulation Schemes in WiMAX.

Radio Resource Management in LTE. Specific aspects of RRM for LTE. Dynamic packet assignment–scheduling; link adaptation and power allocation; handover control; intercell interference coordination; load balancing; MIMO configuration control.

C. APPLICATIONS TOPICS

The students, forming groups of 2-3, will have to make and sustain a semester project based on one of the courses topics.

D. REFERENCES

1. P.-R. Jordi, S. Oriol, A. Ramon, Radio **Resource Management Strategies in UMTS**, John Wiley & Sons, 2005.
2. Jens Zander, Radio **Resource Management for Wireless Networks**, Artech House; 2001
3. Sofoklis A. Kyriazakos, **Practical Radio Resource Management in Wireless Systems**, Artech House, 2004
4. N. D. Tripathi, J. H. Reed, **Radio Resource Management in Cellular Systems**, Kluwer Academic Publishers, 2001.

BROADBAND COMMUNICATION NETWORKS

A. COURSE OBJECTIVES

The course has as main objective to supply the main benefits of wideband and ultra-wideband and to present theoretical and technological problems which appear in practical implementations especially in wireless communications. Also it is presented the potential of this technology in localization, including time of arrival (TOA) estimation, positioning approaches, and positioning accuracy analysis.

B. COURSE TOPICS

1. Introductions. Applications. Antennas. Propagations and Channel Model. Receiver structures (6 hours)
2. Modulation and Signal Detections (3 hours)
3. Mixed Signal Wideband Communications Receivers (4 hours)
4. Analog / Digital Ultra-Wideband Transceivers and Digital Receivers (6 hours)
5. Digital carrier spreading codes for base band wideband access (3 hours)
6. Pulsed wideband interference to narrowband receivers (3 hours)
7. Localization (3 hours)

C. APPLICATIONS TOPICS

1. Simulation of types of wideband modulations
   - single carrier based modulation
   - OFDM based modulation
2. Wideband pulse propagation and detection
   - generalized multipath model
   - IEEE 802.15.4.a channel model
   - Optimum receiver
3. Digital carrier spreading codes for base band wideband multiaccess
   - digital carrier mutiband user codes
   - low duty cycle access in presence of NBI rate access in presence of multipath

D. REFERENCES

1. Xuemin Shen ed. "Ultra-wideband wireless communications and networks", John Wiley & Sons Ltd 2006
2. Jeffrey Reed ed: "An Introduction to Ultra Wideband Communications Systems", Prentice Hall, 2005.
3. W. Pam Siriwongpairat, K. J. Ray Liu, "Ultra-Wideband Communications Systems : Multiband OFDM Approach" Wiley-IEEE Press

ADVANCED MULTIMEDIA TECHNOLOGIES

A. COURSE OBJECTIVES

The course objective is to provide advanced theoretical information of the scientific area, with a strong emphasize for up –to-date technology development. The course goal is to provide information, knowledge in updated technologies used in e-commerce, e-learning and e-government, on the convergence between Internet and mobile communication technologies, as well as the technical presentation of the Information Society technologies.

B. COURSE TOPICS

Tendencies regarding multimedia technologies evolution
Structure tasks and user adaptability
Advanced technologies and software for multimedia applications
Advanced Web programming
HCI (Human Computer Interaction): definition and concepts, implementation strategies
Software Engineering
Mobile multimedia technologies

Infrastructure multimedia technologies
Multimedia applications engineering
Interactive-TV, WebCast, DVB, DAB, Video On Demand
Communication media convergence
Internet security protocols

C. APPLICATIONS TOPICS

Case studies – electronic payment systems, smart-card security, e-leaning, e-voting, e-gouverment
– multimedia infrastructure applications' testing
– software testing (including CGI and API scripts)

D. REFERENCES

1. N. Chapman, J. Chapman – Digital Multimedia, Wiley, 2001
2. J. Watkinson – Convergence in Broadcast si Communications Media, Focal Press, 2001
3. F. Halsall – Multimedia Communications, Addison Wesley, 2001
4. R. S. Tannenbaum – Theoretical Foundations of Multimedia, Comp. Science Press, 1998
5. England, Elaine, Finney, Andy, *Managing Multimedia, Project Management for Interactive Media*, second edition, Addison Wesley Longman Limited, Harlow, England, 1999, ISBN 0-201-36058-6
6. Pirouz, Raymond, Weinman, Lynda, *Click Here, Web Communication Design*, New Riders Publishing, Indianapolis, USA, 1997, ISBN 1-56205-792-8

SPECTRAL ANALYSIS AND ESTIMATION

A. COURSE OBJECTIVES

Introduction of advanced topics in frequency repesentation of signals; non-parametric and parametric estimation techniques and algorithms for quantities related to the frequency representation of signals. The course is motivated by recent developments of the field and its applications in communications, measurement, speech processing, automation, imaging etc.

B. COURSE TOPICS

Introduction: Overview of the field and its applications; Random signals: power, spectral density and coherency; Cramer-Rao lower bound. **Nonparametric spectrum estimation methods:** Periodogram, corelogram, FFT, sampling, windowing, zero-padding: Bias and variance. **Parametric methods for line spectra:** Models for sinusoids in noise, nonlinear least squares method, Pisarenko method, Yule-Walker method etc. **Parametric methods for rational spectra:** AR, MA and ARMA signals; Yule-Walker method, Levinson-Durbin algorithm, Subspace parameter estimation;

C. APPLICATIONS TOPICS

The project will consist of Matlab implementation of a package of algorithms for spectral analysis:

1. FFT and periodograms
2. AR, MA and ARMA processes
3. Pisarenko method
4. The Yule-Walker method

5. The Levinson-Durbin algorithm
6. Adaptive algorithms.

D. REFERENCES

1. P. Stoica, R. Moses, *Introduction to Spectral Analysis,* Englewood Cliffs NJ:1997.
2. S.M. Kay, *Modern Spectral Estimation: Theory and Applications,* Englewood Cliffs NJ: Prentice Hall, 2000.
3. P.M.T. Broersen, *Automatic Autocorrelation and Spectral Analysis,* London: Springer, *2006*.